

COMBAT
AIRCRAFT

137



Peter E Davies

B/EB-66 DESTROYER UNITS IN COMBAT



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SERIES EDITOR TONY HOLMES

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CHAPTER ONE

NAVAL ORIGINS

Although they were built in relatively small numbers, the USAF's 294 B-66 Destroyers were among its most valuable assets from 1956 to 1974. Produced in five versions, but converted into eight variants, the B-66 was derived from the US Navy's A3D Skywarrior attack bomber – the largest aircraft designed to operate from carriers at that time, and the first US Navy jet to be adopted by the USAF.

The US Navy's original specification called for a tactical radius of 2000 miles with a 10,000-lb nuclear weapon, the aircraft flying from the gigantic new carrier USS *United States* (CVA-58). The design for the latter, which would weigh 83,000 tons when fully loaded, had been approved by President Harry S Truman in July 1948. Douglas Aircraft's chief designer, Ed 'Mr Attack Aircraft' Heinemann, doubted that CVA-58 – the first of five so-called 'supercarriers' – would be built (it was cancelled in April 1949, but effectively replaced in 1952 by four *Forrestal*-class carriers) and he scaled back the A3D design to 68,000 lbs so that it could operate from existing, smaller *Coral Sea* class carriers. He allowed for plenty of growth potential and a maximum weight that could, and eventually would, rise to 84,000 lbs. He also assumed that the size of the nuclear weapon that had dictated the basic dimensions of the aircraft proposal would be reduced in later weapon designs, allowing carriage inside the 68,000-lb airframe.

An initial contract for two XA3D-1s was placed in March 1949. The aircraft had a high wing, swept at 36 degrees, twin podded engines and

The origins of the B-66 can be seen in this EA-3B Skywarrior (BuNo 146454, nicknamed 'Killer Whale'), which entered US Navy service in April 1960 and was still flying (with VQ-2) during Operation *Desert Storm* in early 1991 – more than 16 years after the EB-66 had been retired. Its EW equipment was housed in the long Q-Band sideways-looking radar fairing beneath its fuselage, operated by a crew of four
(Author's collection)

a three-man crew compartment. The undercarriage retracted into the fuselage, which was built around a large bomb-bay and had provision for 3100 gallons of fuel. Another 1370 gallons were carried in the wings. One of Heinemann's basic design priorities was weight-saving, and he controversially chose an emergency escape chute rather than ejection seats for the crew, saving 550 lbs.

A3D-1s entered US Navy service in April 1956, providing the fleet with a formidable nuclear deterrent until 1963. A total of 282 Skywarriors would be built between 1956 and 1961, with the aircraft evolving to fulfil a number of roles. In July 1958 the five-seat RA-3B reconnaissance version flew for the first time, followed in December by the seven-seat EA-3B electronic reconnaissance and countermeasures variant. The A3D-2 (A-3B from September 1962) would enter production shortly thereafter, this model featuring more powerful J57-P-10 engines and a deceptive countermeasures package that would eventually replace the bomber's tail guns.

As the US Navy's nuclear priority faded, 85 A-3Bs were converted into KA-3B tankers and 34 became dual role EKA-3B electronic countermeasures and tanker aircraft. Skywarriors subsequently served as the US Navy's standard carrier-based tankers, operating with distinction in Vietnam. They also played their part in the conflict's 'electronic war', serving alongside the critically important electronic reconnaissance variants of the USAF's B-66 Destroyer.

DESTROYER

The B/RB-66 Destroyer was initially ordered as the RB-66A, a replacement for the USAF's piston-engined Douglas RB-26C Invader. The latter was the reconnaissance version of the World War 2-vintage B-26 light bomber, which had seen frontline service from June 1944. Although also effective during the conflict in Korea (and, to a lesser extent, Vietnam), the Invader's participation in this war had revealed the requirement for more capable, jet-powered reconnaissance platforms. This in turn delayed the development of the bomber version of the B-66. To fill the light reconnaissance/bomber gap, 250 license-built English Electric Canberras were purchased as B/RB-57s. The first USAF B-66 Destroyer, which was also intended as an 'interim type' until Tactical Air Command (TAC) could specify a better new aircraft, was actually RB-66A 52-2828, first flown on 28 June 1954.

The Korean War also highlighted the USAF's lack of electronic countermeasures for its tactical aircraft. The main threat to bombers in Korea came from radar-directed searchlights and fighter control radars. Early warning radars were not actively jammed, but chaff (or 'window') was used to mask bomber formations. These deficiencies persisted into the 1960s. The Commander-in-Chief Pacific Air Forces (PACAF), Gen Joseph J Nazzaro, admitted in December 1968 that, 'Prior to the initiation of air operations over North Vietnam, the Tactical Air Forces were practically devoid of EW [electronic warfare] equipment and personnel. Crash efforts to develop, procure and employ EW capabilities to meet Southeast Asian requirements were both late and costly. This situation was fostered by a lack of emphasis on EW equipment, manpower and organisation



at command level. When command emphasis was brought to bear on acquisition of EW equipment, the effort was hampered by a lack of proper EW officer manning and organisation throughout the structure of the Tactical Air Forces’.

After Korea, Strategic Air Command (SAC) operated a number of bombers that were equipped for passive electronic countermeasures, gathering electronic intelligence (ELINT) and building a comprehensive map of an enemy’s network of electronic resources, or ‘electronic order of battle’. For TAC, electronic reconnaissance was needed to provide intelligence on more localised electronic threats to strike forces so that they could either be jammed with stronger transmitters or avoided altogether. Among the active electronic countermeasures, radar ‘blinding’ techniques could entail ‘spot’ jamming of individual radars or ‘barrage’ jamming of a range of frequencies simultaneously. TAC’s reconnaissance wings each received a squadron of RB-26s, with simple ELINT equipment, from 1954.

However, the USAF wanted a faster, jet-powered photo-reconnaissance platform with potential as a light bomber. This was formalised in its RBL-X (Reconnaissance Bomber/Light Tactical Bomber Experimental) competition in June 1951, with a longer-term requirement (to be fulfilled by a Martin or Douglas Aircraft Company design) as the USAF’s WS 302A weapons system. When TAC’s funding was largely determined by its ability to deliver nuclear bombs, RBL-X was to be built around an internally-carried 10,000-lb ‘special’ weapon or a night reconnaissance package. The B-57’s fuselage was too narrow to accommodate a significant amount of ELINT or jamming equipment.

The first RB-66A, 52-2828, is rolled out at the Douglas plant at Long Beach, California. Its first flight, from there to Edwards AFB, California, took place on 28 June 1954 with George Jansen as pilot and Robert Tafey as flight engineer. The most obvious difference from production aircraft, the cockpit canopy, is evident from this elevated angle (USAF)



After the Destroyer's initial test flights, the cockpit canopy was altered to the configuration seen here. Instead of jettisoning the entire canopy, risking severe wind-blast damage to the occupants, three escape hatches were incorporated in the uppersurfaces. Windscreen delamination problems continued for some months, as did fatigue cracks in the control surfaces and engine nacelles. The hatches sometimes blew off during take-off, requiring periodic adjustment of the release mechanisms. Attachment points for rocket-assisted take-off 'bottles' are visible behind the fuselage national insignia. RB-66B 54-436 flew with the 10th TRW from 1957 to 1964, when it was retired (USAF)

RBL-X was also seen as a cheaper, more practical alternative to using the Boeing B-47 Stratojet in a tactical role. An all-weather combat radius of 1000 nautical miles was specified, together with high speeds and altitudes. With an in-service date of 1954, time for completely new designs was limited and several modified versions of existing aircraft, including the B-47, North American B-45 Tornado, Martin XB-51 and the Vickers Valiant, were considered. In October 1951, the Air Research and Development Command supported the B-47 as a high-altitude choice, with the widely favoured XB-51 for low-altitude operations. However, the Martin aircraft fell short on endurance, take-off run, cost and manoeuvrability. The USAF urgently needed a replacement for its B-26 Invaders, however, so Martin was instead given a contract to license-build B-57s.

By then, the USAF Aircraft and Weapons Board had decided that the terms of its specification (including a take-off distance of less than 6000 ft) effectively narrowed the RBL-X field to a Douglas design, based on its imminent A3D-1 Skywarrior. In service, fully loaded RB-66s would actually require far more than an 8000 ft take-off run in hot weather.

Douglas calculated that its Skywarrior could be modified quite easily for the USAF by removing naval equipment such as wing and vertical stabiliser folding and the arresting gear. Upward-firing ejection seats were required instead of escape chutes, a 45-inch scanner for the USAF AN/APS-27 radar system replaced the US Navy's 30-inch unit in a wider radome and anti-icing equipment was added.

The re-design of the A3D-1 was begun by John C Buckwalter's team at Douglas's headquarters in Santa Monica, California, although the first flight of the naval bomber had been delayed until 28 October 1952 by static-test wing failures and late delivery of its J40 turbojets. Ten months earlier, on 15 January 1952, Douglas won the RBL-X competition, and an initial contract for five RB-66As was awarded on 4 February 1952. A production run of 342 aircraft was anticipated, including 127 RB-66As. Inevitably, the modification process was more complex than originally expected as the USAF's requirements became refined. Delays ensued, together with escalating costs.

An increase in wing area by widening the wing root chord gave an extra flap area of 26.4 sq ft. Spoilers were fitted to the wings for improved roll characteristics, the hydraulic and fuel systems were revised and the seating was repositioned. The pilot sat alone in the left front seat, operating the throttles with his right hand and steering with a control yoke. The navigator/bombardier and gunner were sat side-by-side behind him. Larger landing gear tyres were fitted and the US Navy's radio and electronic equipment was replaced with standard USAF items. The twin M3 20 mm guns (in M24A-1 form) of the early A3D-1's Aero 21B tail

turret were retained, but a revised tail cone housed the MD-1 fire control system and a General Electric gun barbette with 500 rounds for each gun.

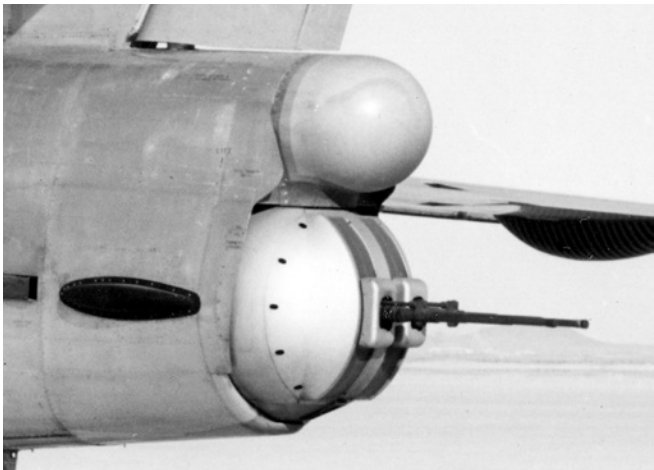
For the B/RB-66 variants, a 17.5-inch extension to the A3D's bomb-bay meant larger nuclear weapons or up to 15,000 lbs of conventional ordnance could be carried. Alternatively, the internal fuel capacity could be increased to meet the 1000 nautical mile tactical radius requirement.

Several major US Navy combat aircraft of the early 1950s had their development programmes disturbed by Westinghouse's failure to produce high-powered versions of its J40 engine. Early models of the turbojet had powered the XA3D-1 prototype, and they were intended for the RB-66, but their severe shortcomings resulted in the move to the outstanding Pratt & Whitney J57 for the second and all subsequent A3Ds.

This engine was preferred by Douglas for the B-66 too, but it was scarce due to its use in much bigger USAF and US Navy programmes such as the Boeing B-52 and KC-135 and several of the Century Series fighters. In June 1952 the Allison J71, which had replaced the J40 in McDonnell's F3H-2 Demon fighter, was selected since the B-66 had been given a lower priority than SAC's bomber fleet, particularly the eight-engine B-52. Although the J71 was never as reliable as the J57, and serious compressor stalls were common in the B-66's early service years, the J71 provided a similar level of thrust – 10,000 lbs – to early J57s. J71-A-11s needed inspection after only 100 hours of service, but the later J71-A-13 was more reliable and capable of developing 10,200 lbs of thrust.

Throughout the B-66's career, the absence of the J57, which eventually generated 15,000 lbs of thrust, placed limits on its performance and serviceability. To compensate for the reduced power, the B-66 could be fitted with up to 12 jet-assisted take-off (JATO) bottles, hooked onto its rear fuselage and briefly providing 12,000 lbs of extra thrust for use on short runways with heavy loads. Although JATO was seldom used, the fitment points were retained on B-66s.

RB-66s had three K-46 cameras and a large K-38 installed in the bomb-bay, together with a chain-driven rack of 48 photo-flash bombs or 104 M112 flash cartridges for night photography. The extensive modifications and additions to the airframe eventually meant that an RB-66 cost 50 per cent more than an A-3D, reduced the aircraft's performance and delayed its in-service date beyond the Korean War.



The M24A-1 20 mm cannon fitted to RB-66B-DL 53-479 at Edwards AFB on 26 November 1957. The weapons were aimed with a cross-hair sight on the gun-laying radar screen in the gunner's area of the crew compartment. Removing the weapons caused a forward movement in the jet's centre of gravity (*Terry Panopalis*)

INTO PRODUCTION

Early test flights revealed problems with flutter, the flight controls and over-long landing runs, all of which were corrected in time for production of 294 B-66s to begin at Douglas's Long Beach, California, plant and at the US government's Tulsa, Oklahoma, facility. The USAF's decision to

split production in this way added greatly to costs and complicated the management of the programme.

After five RB-66As had left the production line, the first RB-66B flew on 4 January 1955. Entering service in 1957, the B-model had the seldom-used capability to carry two external 450-gallon drop tanks, replacing some of the internal fuel capacity sacrificed for additional electronic equipment and adding about an hour of flight time. The B-66B bomber version was ordered in April 1952, with 72 aircraft acquired to replace the B-45A. It used the B-47's Western Electric K-5 bombing system and AN/APS-23 radar, the prototype first flying on 4 January 1955.

Douglas's plant in Tulsa, Oklahoma, built 36 RB-66C electronic reconnaissance variants (first flown on 29 October 1955) with similar equipment to SAC's RB-47H, and 36 WB-66D weather reconnaissance aircraft, replacing half the original RB-66C order. WB-66Ds, delivered in 1957 as the final B-66 batch, were based on the RB-66C. Their five-man crew included two observers in a bomb-bay capsule to conduct atmospheric research and provide precise weather data in combat areas. As the WB-66Ds never received their full complement of scientific equipment, they primarily undertook visual reconnaissance missions. Several were converted for test programmes, and at least one (55-390) became an RB/EB-66D.

TAC saw the RB-66C as an interim aircraft, pending the availability of faster types such as the RF-105 Thunderchief, or the RF-4C Phantom II with a pod containing ELINT sensors. The RF-105 was ruled out when F-105 production was delayed and the RF-4C pod was not funded, requiring the RB-66 to remain in service. Longer term, TAC foresaw the General Dynamics RF-111A as the solution, but long delays and cost overruns with the troubled F-111 programme denied TAC that option too.

The RB-66Cs were the heaviest, most expensive, most complex and, in many respects, the most important of the B-66s, and TAC would be relieved that they were not retired in 1964 as had originally been planned. They were the first aircraft to be equipped from the outset to survey and evaluate the electronic environment in hostile airspace, and then defeat the threats with their own countermeasures. Up until the RB-66Cs' entry into service, TAC had relied upon SAC for its electronic intelligence data. With the acquisition of RB-66s, TAC now had its own means of monitoring hostile airspace in support of tactical operations. Furthermore, RB-66s could lead strike forces safely to their targets.

Bristling with an increasingly complex array of antennas for its central AN/APD-4 automatic receiver system, the RB/EB-66C had nine jammers that could be tuned in flight. By 1967, the system's original wire recorders had been replaced by 14-track Leach audio and video recorders. Externally, the upgraded equipment was identifiable by AN/APD-4 antenna pods under each wingtip for an airborne direction-finding system that identified and recorded radar emissions in the 1000-30,000 megacycles per second range. The EB-66C fulfilled the USAF's requirement for an electronic reconnaissance aircraft.

However, TAC's reliance on SAC had also involved the slow provision of electronic reconnaissance equipment for its RB-66Cs. Essentially, this consisted of 'off the shelf' items funded by SAC and used since 1953 in



its RB-47H Stratojet. In practice, the AN/APD-4 received unmanageably large quantities of data, and the system was replaced by simpler methods of analysis. Although the collected data was useful, the location of threat signals had to be plotted manually through very accurate navigation. By the late 1960s, the system had been effectively deleted and the distinctive fibreglass wingtip pods were empty – they were retained, however, as they did not affect the jet's handling.

The RB-66C's bomb-bay contained a pressurised module for a four-man crew of ELINT operators (known as 'Ravens', and preferably less than 5 ft 9 in tall due to the small hatches for their downward-firing ejection seats) working on AN/APR-9 or -14 rapid scan and panoramic receivers, AN/ALA-6 direction finders, AN/ALA-5 pulse analysers and a wire recorder. AN/APD-4 azimuth indications were shown on the No 3 Electronic Counter Measures (ECM) console display in the crew compartment. All four aft crew positions were packed with ECM displays and controls for the forward-facing operators, who entered the compartment through a hatch at the forward end and took their places in Douglas ejection seats. Although the seats were supposed to have a minimum safe ejection altitude of only 400 ft, it was generally considered that an effective ejection required significantly greater altitude.

When both engines of RB-66C 54-460 flamed out on approach to RAF Chelveston, Northamptonshire, on 7 February 1962, the bail-out order was given when the aircraft descended below 700 ft, but only the navigator ejected successfully. Two seats failed, although the pilot and an electronic warfare officer (EWO) escaped from the wreck on the ground. Three EWOs in the aft compartment and the flight engineer could not eject and were killed.

As electronic reconnaissance had a low priority in TAC, little was spent on upgrading the RB-66Cs' systems before the jets were transferred to Southeast Asia for the Vietnam War. Aircraft did receive extra jammers, however. Electronic interference between the ECM, navigation and

The third RB-66C, 54-450, was photographed on 19 February 1957 whilst assigned to the Air Force Flight Test Center at Edwards to test the aircraft's EW equipment. Fibreglass wingtip pods were unique to the RB-66C version. This aircraft was subsequently reassigned to the 16th TRS/363rd TRW at Shaw (Terry Panopolis)

radio equipment also took time to analyse and solve in the early 1960s. Meanwhile, SAC's electronic reconnaissance assets had received regular updates, although TAC's RB-66Cs had the ECM protection that was lacking in SAC's RB-47s.

In Vietnam, the RB-66B and RB-66C became a formidable pair, with the latter detecting and analysing hostile radar signals for the RB-66B to jam. In 1966 the USAF re-designated its reconnaissance aircraft, using the 'R' prefix for photo or infra-red (IR) reconnaissance and 'E' for electronic surveillance types. RB-66s thereby became EB-66s.

In December 1964, EB-66s began to receive the first of many wartime updates, adding two active ECM systems and three-phase electrical power. QRC-114 (AN/ALT-16) *Green Dragon* barrage jammers were also eventually installed in EB-66Cs among eight new ECM systems. An attempt was made in 1966 to fit AN/ALQ-96 semi-automatic reconnaissance systems in nine retired WB-66Ds, thus giving them much the same capability as was provided by the four EWOs in an EB-66C. After extensive tests in EB-66C 54-467, the AN/ALQ-96 could not be made to work satisfactorily and the project was scrapped.

The small numbers of EB-66Cs available to TAC also led to the conversion of a batch of RB-66Bs into EB-66Es for both crew training and wartime operations from 1967. Upgraded RB-66Cs were also re-designated as EB-66Cs. The Dynalectron company, in conjunction with the USAF's Sacramento Air Materiel Area, adapted 52 RB-66Bs with improved active and passive ECM systems, including 21 jammers in place of cameras and an ECM tail cone instead of guns.

Preceding the creation of the EB-66E by a full eight years, 13 B-66Bs had been converted into *Brown Cradle* EB-66Bs from May 1959 in order to test the concept of active electronic jamming within USAFE operations. In the December 1964 Big Sail programme, QRC-95 *Green Dragon* jammers appeared in EB-66Bs – modified aircraft boasted several large 'sail' antennas above and on the sides of the fuselage. The refurbishment added significantly to the aircraft's all-up weight, taking it beyond the 83,000-lb mark of the EB-66C. Like many other B-66Bs, it exchanged tail guns for an ECM fit, despite TAC's initial insistence on the gun installation. An EWO sat on the right side of the cockpit area and the navigator was moved behind the pilot. As pure jammers, these aircraft relied on teaming up with an EB-66C to locate threats and warn the EB-66B of them.

While most of the USAF's tactical missions were flown in daylight during this period principally because TAC had no truly capable all-weather strike aircraft until the late 1960s, the EB-66 was capable of supporting night missions by SAC bombers, as well as some tactical night flyers. Its electronic warfare (EW) missions included:

- ECM. For the EB-66, this meant jamming enemy radar emitters that provided early warning or controlled enemy anti-aircraft defences. This included ECCM, counter-jamming enemy attempts to defeat the EB-66's jammers.
- ESM (electronic support measures) involved the collection and analysis of enemy electronic emissions to facilitate jamming.
- ER (electronic reconnaissance) or ELINT encompassed all forms of electronic data gathering.



CHAPTER TWO

COLD WAR BOMBER

When the USAF was forced to cut Destroyer production from 363 to 294 aircraft in 1955, the B-66B bomber was hardest hit. In 1954, two of TAC's six light bombardment wings, the 47th and 354th BW(L)s, were to be equipped with 138 B-66Bs. By May 1955, a 15-month delay in production, cost overruns and a general reduction in tactical forces after the Korean War had cut B-66B production to just 69 aircraft. Also, the costly Western Electric K-5 (based on the established AN/APQ-24) bombing system was unable to fulfil the USAF's requirements for accuracy.

Ultimately, only the 17th BW, commanded by Col Howard Bronson, received B-66Bs. Based at Miho AB, Japan, the wing was one of the oldest air force units. Its 34th Bombardment Squadron (BS) had commenced transition to the B-57B when the wing was ordered to return to the USA in April 1955. The unit, together with the B-26-equipped 37th and 95th BSs, duly flew to Hurlburt Field, Florida, to convert to B-66Bs – its last Destroyer was delivered on 18 September 1957. The 34th's switch to the jet bomber was hampered by the lack of a dual-control trainer variant of the B-66.

In 1956 TAC began to assemble a Composite Air Strike Force (CASF). This concept, which had been initiated by TAC commander Gen Otto Weyland, combined various aircraft types as a unit for rapid deployment to trouble spots worldwide. The first such deployment was Operation *Mobile Baker* in September 1956, which was intended to show that a

B-45A-5-NAs are lined up at Langley AFB, Virginia, in July 1952, ready for transferring to Sculthorpe and service with the 47th BW(L). The Tornado, the first operational four-jet aircraft, was also the USAF's first jet bomber and the B-66B's direct predecessor. Sculthorpe had operated the RB-45C Tornado with the 91st Strategic Reconnaissance Wing since 1951 (USAF)

relatively small nuclear-capable tactical force, with conventional ordnance options, could deliver the same retaliatory action as a much larger but less coordinated armada of conventional attackers.

Although they were prioritised for 'special weapons', B-66B bomb-bays could be configured for 14 750-lb M117 general purpose bombs or four 3000-lb weapons. Organised from Foster AFB, Texas, by the Nineteenth Air Force, the CASF included a nuclear strike core of 16 F-100C Super Sabres from the 322nd FW(Day), 16 366th Fighter-Bomber Wing F-84Fs and four 17th BW B-66Bs. Four RF-84Fs from the 363rd Tactical Reconnaissance Wing (TRW) provided photo-reconnaissance, and a tanker force with both Flying Boom KB-29 and drogue-equipped KB-50 (for the F-100Cs and B-66Bs) refuelling methods was provided.

The force flew the 3000-mile trip to bases in Italy and to Spangdahlem AB, West Germany, for Exercise *Whip Saw* in September 1956. B-66Bs carried rarely fitted external tanks, some of them painted olive green. On the return flight, B-66B 54-497 lost power in both engines due to fuel-flow constriction, and Capt Zac Ryall's crew had to eject over Virginia from the first B-66 to be lost in an accident. It was later determined that jet fuel thickened at altitude and could not pass through fine fuel filters. WB-66D 55-394 was lost to similar causes, combined with icing, in September 1961, as was RAF Chelveston's RB-66C 54-460 on approach to landing in February 1962. In both cases, modified fuel filters had yet to be installed.

Operation *Mobile Zebra* in November 1957 deployed a 47-strong CASF across the Pacific. Three B-66Bs, reduced to two by in-flight refuelling problems, were accompanied by 32 F-100C/D fighters from George AFB, California, and five 17th TRS RF-101A Voodoos from Shaw AFB, South Carolina, to bases in Japan, from which the B-66Bs flew practice bombing missions in the Philippines. WB-66Ds from the 9th TRS were also included.

B-66B-DL 53-482 spanned the history of Destroyer development. It was initially supplied to the 86th BS/47th BW in 1958, but a year later it was converted into a *Brown Cradle* EB-66B and transferred to the 42nd TEWS/10th TRW. Six years later it was assigned to the 25th TRW, before moving to the 6460th TRS/460th TRW in 1966. Selected for EB-66E conversion, the aircraft flew with the 42nd TEWS/355th TFW in combat until retirement in May 1970 (USAF)

SCULTHORPE

After a relatively brief TAC career that ended with their replacement by supersonic F-105D Thunderchiefs carrying the new generation of smaller Mk 28 and Mk 43 nuclear weapons internally, the 17th BW's small B-66B



force was transferred to the 47th BW at RAF Sculthorpe, in Norfolk. The most important British nuclear base in the early 1950s despite its primitive facilities, Sculthorpe's satellite airfield was RAF Alconbury, in Cambridgeshire. The first B-66Bs arrived in England in January 1958 for the 84th, 85th and 86th BSs, all three units having formerly been equipped with B-45A Tornados.

The bombers had been transferred to Sculthorpe just under a year after the first RB-66Bs had been delivered to replace RB-45C reconnaissance bombers with the 19th TRS, controlled by the 66th Tactical Reconnaissance Wing (TRW) at Sembach AB, West Germany, and later by the 10th TRW at Spangdahlem AB, also in West Germany. The 19th's RB-45Cs routinely flew photo-reconnaissance missions that saw them penetrate up to 1000 miles into Soviet airspace. Based at Sculthorpe and flown by RAF crews led by Sqn Ldr John Crampton, the RB-45Cs were repainted in RAF markings and flown as far as Moscow at night. Although they were detected by Soviet search radar, communist defences were unable to intercept them.

With the arrival of the B-66B, the 47th BW replaced the single Mk 5 'Fat Man' nuclear weapon carried by the B-45A with two smaller 18 ft-long Mk 28 nuclear bombs for delivery on pre-arranged targets from 38,000 ft. Pre-flight, the B-66B pilots – who had assumed TAC's nuclear mission from B-45 crews from 1956 – had to plug the bomb in and select the required yield for the mission (up to 1.1 megatons) on a panel in the weapon's tail. Aircraft with two bombs were usually given two targets behind the Iron Curtain. Crews could be assigned to the same targets for several years running, constantly practicing simulated attacks on them.

Like many nuclear alert crews, the B-66 flyers knew their chances of returning alive were small. A B-66B, with the flash curtains drawn across its cockpit windows, would have dropped a Mk 28 hydrogen bomb and then turned away as fast as possible. However, with a maximum speed of just Mach 0.98, the aircraft would still have been exposed to the explosion. B-66Bs also proved to be unsuitable for low altitude bombing system attacks.

Destroyer crews spent seven days in isolation on a rota when undertaking Victor Alert readiness, which saw two aircraft from each squadron armed and ready to take off within five minutes of receiving the order to scramble. The public was assured that 'nukes' were never flown over the British mainland, with crews dropping blue concrete practice bombs when training on the Jurby, Isle of Man, sea range. They would also routinely perform simulated attacks on radar bomb-scoring sites across Britain. The wing's B-66 units suffered four fatal accidents at Sculthorpe during the aircraft's four and a half years in Britain, which compared very favourably with the 37 serious mishaps, including seven major engine fires, experienced by the 47th BW when it was equipped with the B-45.

By 1961, improved Soviet defences, particularly the introduction of the SA-2 surface-to-air missile (SAM), had forced SAC to re-evaluate and soon reduce its high-altitude bomber fleet. Its priority shifted to interception-proof intercontinental ballistic missiles, while TAC also saw that its B-66s were too vulnerable and introduced the F-105D fighter-bomber and short-range MGM-1 Matador and MGM-13 Mace surface-to-surface missiles in their place.

Within that scenario, the B-66B became an easy target for force reduction. The 47th BW, supported by KB-50J tankers of the 420th Air Refuelling Squadron, was inactivated on 22 June 1962 and some of its aircraft were transferred to the 42nd TRS/10th TRW at Chelveston, where they received an ECM tail cone modification in place of guns. The gunner's seat then became available for instructor pilots or navigators.

USAFE RECONNAISSANCE

USAFE had two tactical reconnaissance wings, namely the 10th TRW, which was activated in 1952 at Toul-Rosières AB, in France, and the 66th TRW that arrived in Europe in July 1953. The 10th acquired its first RB-66C (54-459) for its 42nd TRS on 28 November 1956, replacing RB-26s at Spangdahlem. RB-66Bs then re-equipped the wing's 1st TRS, with its previous RB-57As being used by 42nd TRS crews to gain jet experience. The shortage of qualified pilots delayed the 42nd's operational debut until 1957, and all 12 RB-66Cs were finally in place by the end of that year.

The 30th TRS converted from RB-57As to RB-66s in 1957, although its early operations were conducted from Landstuhl AB, in West Germany, due to inadequate runways at Sembach, where conversion training was provided for Destroyer crews in an atmosphere of post-war austerity. In December 1957 USAFE decided to simplify the composition of its two reconnaissance wings by transferring all of its RF-84F Thunderflash squadrons to the 66th TRW and making the 10th TRW an all-RB-66 wing. The 19th TRS was duly transferred to the 10th TRW in March 1958, although it remained at Sculthorpe until 10 January 1959, when the unit joined the 1st, 30th and 42nd TRSs at Spangdahlem, although only for seven months. This move made room for the 86th BS, whose B-66Bs transferred from Alconbury to Sculthorpe.

The 42nd TRS's Weather Flight also received seven WB-66Ds in late 1957 to provide aircraft formations with a degree of advanced navigation capability in challenging European climatic conditions. They were especially useful when planning deployments to airfields such as Wheelus AB in Libya or Adana AB in Turkey, or when flying 'Space Cadet' missions along the East German border and reconnaissance sorties over the Black Sea. At Wheelus, two WB-66Ds also flew high-altitude 'Golf Ball' sorties

The pilot of RB-66B-DL 54-507 tucks up the aircraft's undercarriage shortly after take-off, probably from Alconbury. Supplied to the 19th TRS/10th TRW in 1958, this aircraft was placed in storage in June 1965 and subsequently selected for conversion into an EB-66E in March 1969. After two years with USAFE's 36th and 52nd TFWs, it moved to the 363rd TRW and remained with the wing until its retirement in 1974. RB-66Bs required up to 6000 ft for take-off in a cool climate. Pilots generally found its handling characteristics agreeable, although tight turns resulted in considerable loss of altitude (USAF)



to study wind conditions so that the US could monitor fallout from French nuclear tests in Algeria.

RB-66Cs of the 42nd TRS regularly flew ELINT missions along the East German, Czech, Albanian and Yugoslav borders, and in January 1958 an aircraft inadvertently crossed the border after its AN/APN-82 navigation radar failed. The Soviet defences did not respond on that occasion, but thereafter, aircraft were forbidden from approaching the border without fully functioning navigation aids.

USAFE's RB-66B 'night photo jets' offered a 100 mph increase in cruise speed over their RB-45C predecessors, giving better protection from the enemy fighters that were their main opposition prior to SAMs becoming a real threat. With a maximum low-altitude speed of just over 640 mph, Destroyers could out run most contemporary fighters. Their designated USAFE missions were low-altitude night photographic reconnaissance, weather reconnaissance and INTEL gathering.

The RB-66s also suffered teething problems in USAFE service in 1958, resulting in two early losses. These were partly due to a delay in training sufficient specialist groundcrew on the aircraft's complex radar systems, de-icing and heating equipment. In three incidents involving the MA-3 mobile ground power unit, maintenance crews unfamiliar with its braking system operated its controls from outside the vehicle and the unit ran backwards into a B-66, causing severe damage.

In-flight problems included hydraulic failures, which required manual operation of the undercarriage on several occasions. On 4 July 1958, Capt William Marcum and his crew had to eject from RB-66B 54-433 on their return flight from Spangdahlem to Sculthorpe when both the hydraulic and manual undercarriage systems failed. The aircraft continued to fly on autopilot until it ran out of fuel and crashed near Norwich, in Norfolk. Three months earlier, on 14 April, 19th TRS aircraft 54-422 had crashed on short finals while attempting a blind landing at Sculthorpe. Pilot Capt R E Taylor and his two crewmen were killed when the jet deviated from its approach pattern and crashed after an explosion on board.

USAFE units were mobilised during the Lebanon crisis in July 1958, requiring the 42nd TRS to maintain a constant electronic monitoring presence in the area, as well as providing weather data for the US task force assembled for Operation *Post Card* and an invasion that was not in the end required. CASF Bravo was to have included the 363rd Composite Reconnaissance Squadron with six RB-66Bs, three RB-66Cs, three WB-66Ds and six RF-101 Voodoos, although the RB-66 element actually comprised eight jets when the force assembled at Incirlik AB, Turkey, on 20 July. The absence of RB-66Cs meant that little information could be gathered concerning the effectiveness or location of Syria's radars.

Most of the action during the crisis consisted of reconnaissance flights at the request of the US Army. The RB-66s were denied the opportunity to fly night missions as their photoflash cartridges could have been mistaken for bombs. This meant that they were restricted to daylight missions only, and their slow speed and low altitude (both requirements for pin-sharp photographs) made them easy targets for ground fire. Four aircraft were indeed hit by 0.30- and 0.50-calibre small-arms fire while flying over Lebanon, Syria and Iraq. Consistently fine weather made the WB-66D



RB-66Bs with their TAC KB-50 tankers en route from Langley to Alconbury in September 1961 for service with the 19th TRS/10th TRW. In-flight refuelling required a closing speed with the tanker that prevented air pressure ahead of the aircraft from building up and pushing the refuelling basket to one side of the probe. Pilots had to reach down for the in-flight refuelling switch, awkwardly placed near the cockpit floor. As the fuel load increased, the B-66 pilot asked his counterpart in the tanker to make a shallow 'toboggan' descent so that the B-66 avoided an excessive nose-high attitude
(Terry Panopalis)

missions superfluous, and they were the first to return to the USA, followed by the RB-66Bs by 6 September.

Training programmes for 10th TRW Destroyer crews included regular participation in NATO reconnaissance competitions such as *Royal Flush*. 19th TRS RB-66B 54-430 and its crew were lost over the Friesian Islands during a night photo-reconnaissance sortie on 16 March 1961 while practicing for that year's *Royal Flush*. In Operation *Taxi Cab* during 1959, RB-66s and WB-66Ds were tested as pathfinder aircraft, using their superior radar navigation gear to guide F-100Ds of the 36th and 49th TFWs to targets at night and in bad weather. An RB-66 pathfinder then flew a bomb damage assessment (BDA)

photographic run over the target. It was a way of filling the USAF's long-standing need for effective all-weather attack capability which was not effectively remedied until the acquisition of the F-111A. 'Taxi Cab' pathfinder tactics with EB-66s were frequently used in the Vietnam War during monsoon conditions. However, in Britain, consistently poor weather caused up to half of all RB-66 missions to be cancelled.

EXIT FRANCE

In July 1959 all foreign nuclear forces were expelled from France, and its president, Gen Charles de Gaulle, created his own national nuclear deterrent force. The 66th TRW's unarmed RF-101C Voodoos were allowed to remain at Laon AB, but the 49th TFW's F-100s were moved from Chalons-Vatry AB to Spangdahlem, displacing the 10th TRW. Its 1st and 31st TRSs moved to the 47th BW's secondary base at Alconbury in August 1959, replacing the 85th BS's B-66Bs.

Fortunately, two other British bases were also available. One of them was RAF Bruntingthorpe, in Leicestershire, which had been refurbished in 1957 as a satellite airfield for Alconbury. The base, which had played host to SAC B-47s when on 'Reflex' deployments, received the 19th TRS/10th TRW RB-66Bs that had transferred from Sculthorpe to Spangdahlem seven months previously. The former Eighth Air Force B-17 base at Chelveston, also a 'Reflex' B-47 airfield, became the home for the 42nd TRS's RB-66s when they left Spangdahlem. Like Sculthorpe's B-66Bs, their tenure was fairly brief.

In August 1962 the RB-66Bs from Bruntingthorpe and Chelveston's RB-66Cs were deployed to Toul-Rosières, where they had made frequent temporary visits. As they were now closer to the East German border, along which most of their reconnaissance missions were flown, the Destroyers no longer required KB-50 tanker support. Chelveston and Bruntingthorpe were closed. At Alconbury, which was home to the



10th TRW's headquarters, two RB-66B squadrons were active until May 1965, when the wing began to convert to the RF-4C Phantom II. The 19th TRS then returned to the USA, where it was attached to the 363rd TRW at Shaw AFB.

During their short time flying from British airfields, the RB-66s were considerably further from their normal patrol routes in West Germany and in-flight refuelling became more commonly used. Participation in *Royal Flush* competitions continued, and there were some effective specialised tasks for the RB-66s. One involved testing radar defences in East Germany. Provoking a response from hostile radars was only possible by directly challenging them to give away their position and reveal important information about the nature of their emissions.

On 22 December 1959, for example, F-102A Delta Daggers of the 86th FIW flew a 'ferret' mission, accelerating towards the border at high altitude and supersonic speed. As they crossed briefly into East Germany before turning away, they forced a semi-mobile P-35 'Bar Lock' (Saturn) early warning radar to engage, revealing previously unknown data to a 42nd TRS RB-66 lurking nearby.

Such intrusions did not always go so well. On 10 March 1964, 19th TRS RB-66B 54-541 from Toul-Rosières strayed across the border, having wandered 120 miles from its assigned course. The crew had actually been tasked with photographing bridges near Osnabrück, on the West German side of the border. Maj David Holland and his crew, consisting of instructor navigator Capt Melvin Kessler and newly-qualified navigator 2nd Lt Hal Welch, descended for what they assumed would be the low-altitude photographic part of their mission, only to find themselves overflying a Soviet exercise involving 6000 troops in the central Berlin air corridor near Stendahl, 20 miles into East Germany!

Two MiG-19s of the 33rd Fighter Aviation Regiment, flown by Capt Vitaliy Ivannikov and Fyodor Zinoviev, were scrambled from Wittstock AB in East Germany and quickly intercepted the RB-66B. They duly caused severe damage to its hydraulic systems with 23 mm gunfire and C-5 rockets. When the flight controls froze, the crew was forced to abandon the

USAF flypasts including Destroyers, often accompanied by a selection of Century Series fighters, were welcome sights at many European airshows in the 1960s. This trio of 10th TRW RB-66Bs pleased the crowds at Alconbury's 1960 Open Day. The 30th TRS's 54-(O)537, leading the pack, eventually operated in Vietnam as an EB-66E, while 54-(O)512 of the 1st TRS on its left wing was struck off charge in 1966 (Terry Panopalis)

burning aircraft in a 460 mph spiral dive near Gardelegen. Ivannikov was emboldened to pursue his rear attack at close quarters when he noticed that the RB-66B had no tail guns, 'otherwise we would have been immediately destroyed'.

All three crewmen were recovered by the communists, with Welch having been seriously injured. The East Germans regarded the incident as a spy flight to test their air defences, and acted accordingly. At Toul-Rosières, it was established that a fault in the basic navigation aid, an N-1 magnetic compass, had misled the crew, who were returned 17 days later after intensive interrogation. Maj Holland remained in the USAF after the subsequent enquiry exonerated him, and he went on to fly 146 combat missions in Vietnam.

As a result of this incident, an Air Defence Identification Zone was established along the German and Czech borders. Under 'Brass Monkey' rules, any aircraft entering the zone without permission was contacted on the Guard radio channel and ordered to turn back. It was an attempt to end the loss of US airmen, amounting to 108 since 1950, who had perished when crossing the border.

BROWN CRADLE

The need for a dedicated ECM aircraft within USAFE to escort tactical strike packages was partially satisfied from January 1960 by the arrival of 13 ex-47th BW B-66Bs following *Green Dragon* ECM tests at Griffiss AFB, New York, with two aircraft in October 1959. Inspired by a SAC EB-47E Stratojet ECM jamming conversion programme codenamed *Blue Cradle*, the revised B-66Bs were called *Brown Cradle*. Whereas the 90 expensively modified EB-47Es would have provided escort packages for Stratojet bombers, the *Brown Cradle* B-66Bs were intended to make up for the Destroyer's own lack of sufficient ECM self-protection. TAC initially saw the innovative conversion as a successful addition to its forces for air defence exercises such as the US armed forces weapons evaluation tests (WEXVAL) in the 1950s that had demonstrated the Command's limited radar jamming capability. For the 1959 tests, it fitted 13 17th BW B-66Bs with jammers, an AN/APS-54 radar warning receiver (RWR) and an external chaff dispenser.

From May 1959 the aircrafts' guns were replaced by the ECM tail cone, housing two jammers and an AN/ALE-1 chaff dispenser with a chute beneath the tail fed by two chaff hoppers. A 'cradle' in their bomb-bays contained up to 18 radar jammers. The weight changes added 17 mph to the B-66B's maximum speed and more than 100 nautical miles to the range. The noise jammers that were employed included either AN/ALT-6/6Bs (also fitted to B-52 Stratofortresses) or AN/ALT-7, -8 and -8Bs, together with the AN/APS-54 RWR, which had been recommended for the B-66 since March 1953. The gunner was replaced by an EWO, who had large fold-away panels covered in instruments to monitor the jammers in the bomb-bay 'cradle'.

Since none of this equipment could be adjusted in flight, extensive RB-66C 'ferret' flights had to be arranged to map the frequencies of suspected threat radars in any area where *Brown Cradle* jamming was to



be delivered so that the jammers could be pre-set accordingly. The EWO then only had to switch units on or off in flight.

In 1954 TAC wanted 50 *Brown Cradle* pallets as a 'plug-in' option for the entire B-66 fleet. They were to be installed into a pre-wired bomb-bay if a mission demanded ECM escort. Optional ECM tail cones, eventually amounting to 113 units, were requested to replace guns ad hoc. The 16th TRS at Shaw began to re-fit its RB-66s with the ECM tail cone beginning with 53-424 in November 1958.

The modified B-66Bs proved to be far more effective against US Army radars than the *Blue Cradle* version, and WEXVAL II tests, in which three *Brown Cradle* aircraft escorted simulated attacks by F-100s on US Navy ships, showed that the jammers could defeat naval radars and fighter interception too. Initially in 1954, smaller ECM 'cradles' were proposed for installation in B-66Bs that would also be accompanied by *Brown Cradle* aircraft in high threat situations. The modified aircraft also retained their B-66B K-5 bombing-navigation system, which was considered better than the navigation systems in other B-66 variants because it could track targets at a range of 40 miles. *Brown Cradle* had proved its worth, but there was no funding to modify more 'obsolete' aircraft when fighter-carried ECM pods were thought to be imminent.

On return to the 47th BW, the *Brown Cradle* aircraft proved themselves much more capable of defeating radar detection than standard B-66Bs. One consequence of this was the decision to replace tail guns with ECM tail cones, which provided more practical protection from fighter interception at night. It also saved weight in an aircraft that was nearing the 83,000-lb all-up weight that Ed Heinemann had allowed for. British-based RB-66Bs lost their guns in 1960 and gunners were replaced by flight engineers.

In 1962 the *Brown Cradle* aircraft were transferred to the 42nd TRS/10th TRW at Chelveston because USAFE's need for them was greater than Shaw's. They soon moved to Toul-Rosières, replacing WB-66Ds, and began to accompany Victor Alert strike packages of F-100Ds. Detachments of up to four jets were also sent to other B-66 bases including Alconbury. Their own alert posture was dubbed Echo Alert, while the 19th TRS operated Whiskey Alert, but both required readiness to escort fighter-bomber strikes at 15 minutes' notice. The 10th TRW had alternative bad weather diversion airfields at Morón AB, in Spain, and Nouasseur AB,

The 10th TRW insignia appears here with a white background on this 30th TRS RB-66B, although the squadron's yellow engine nacelle sash is absent. 54-540 became an EB-66E in November 1967 and joined the 42nd TEWS/388th TFW at Korat in 1971. On 2 February 1972, whilst being flown by Capt Neil Henn as 'Cobra 25', the jet rotated at 161 mph and the pilot retracted its undercarriage. However, the tail and ECM antennas scraped along the runway and the aircraft skidded for 5000 ft before coming to a halt. The crew escaped, but this Destroyer became a parts source over the following year, before being consigned to the fire dump (USAF)



Proving that it was possible to abort a take-off with the undercarriage retracted, RB-66-DL 54-(O)543 of the 19th TRS/10th TRW deployed its airbrakes and braking parachute to grind to a halt on Alconbury's runway in January 1964. The whole crew exited unharmed through individual hatches. The engines were protected when taxiing on the ground by foreign object damage shields inside their intakes, which retracted after take-off (USAF)

in Morocco, from where far more flying hours could be chalked up than the squadrons could hope for in the poorer northern European climate.

Brown Cradle B-66Bs flew the USAF's first active ECM missions in Exercise *Cold Turkey* in 1961, briefly jamming radars in East Germany. ECM tail cone-equipped RB-66Bs also provided ECM and ECCM training, including chaff dispensing, for other NATO air forces that year. Their EW equipment was tested in flights with EB-66Cs, which monitored the jammers, plotting their signals and transmission patterns. Using the jammers or chaff near populated areas was understandably discouraged. Inadvertent jamming of friendly US radars during Vietnam missions would become one of many headaches for EB-66 crews.

In 1965 the 42nd TRS was reassigned to the newly formed 25th Tactical Reconnaissance Group (TRG) at Chambley-Bussières AB, France, which was part of the first dedicated USAF electronic warfare wing. It was joined by the 19th TRS, brought back to USAFE with its ageing RB-66Bs and photo-processing equipment to cover the delay in the operational acceptance of the RF-4C. B-66 crews soon found that the concrete used by French contractors for the runway was too thin and the heavily laden RB-66Bs sometimes broke through the surface. The compulsory exit from France soon brought about the inactivation of the 25th TRG in August 1966, and both of its squadrons re-emerged as the 19th Tactical Electronic Warfare Squadron (TEWS) in Thailand for the conflict in Vietnam and the 42nd TEWS at Shaw.

If the Vietnam War had not intensified, the retirement of the remaining RB-66s would have progressed rapidly. It would rapidly rob USAFE and NATO of EW capability with the transfer of RB/EB-66s to Southeast Asia in 1966-67, although this was not explained to European or USAFE commanders at the time. As a stop gap, until the EB-66s could perhaps be returned or replaced, temporary *College Caper* deployments by US-based EB-57Es (used for training in Air Defense Command's Defence Systems Evaluation Squadrons) were planned periodically, with the proviso that the Canberras would transfer to Europe at short notice in emergencies. Another plan called for annual visits to West Germany by 4417th Combat Crew Training Squadron (CCTS) EB-66s, but they were all inadequate solutions. The real remedy came in 1969 when the USAF was persuaded to base the 39th TEWS and its EB-66C/Es in West Germany.



CHAPTER THREE

YOKOTA AND SHAW

When radar-directed anti-aircraft artillery (AAA) fire threatened USAF B-29 Superfortress night attacks during the Korean War, the bombers were hastily equipped with three World War 2-era jammers, chaff dispensers and some radar pulse analysers. SAC had initially been reluctant to employ its limited radar and radio jamming equipment in order to disguise its capability from North Korea's resident Soviet technicians.

Some RB-26 tactical bombers were also fitted with countermeasures in 1953-54 and one had ELINT capability, but the contemporary technology was similar to devices installed in a few B-17s and B-24s that could 'ferret' out German radar emissions during World War 2. Barrage jamming was also used, but many of the newer Soviet radars were powerful enough to 'burn through' its emissions. North Korean radar operators learned to vary the frequencies of their early-warning or AAA radars to avoid single-frequency spot jammers. Eventually, 'sweep' jammers were developed, which allowed ECM operators to adjust their own jamming to match the varying hostile frequencies. These devices were incorporated into SAC's 90 EB-47 Stratojets, and comprehensive jamming suites were installed in its B-52s.

TAC, on the other hand, did not heavily invest in countermeasures after World War 2. Apart from the RB-66, its aircraft could not carry the bulky ECM black boxes fitted into SAC bombers. Its fighter-bombers

RB-66B-DL 53-473 in the markings of the 43rd TRS/363rd TRW in early 1959 at Shaw, shortly before it was lost in a mid-air collision on 8 May with 53-418 as it moved into position to take a photograph of an RB-66B formation over the city of Sumter, South Carolina. Navigator Capt Julian Stewart was the only crewman unable to eject successfully. The B-66's seating arrangement, with no co-pilot's position, meant that instructor pilots had to sit on a box behind the student pilot, with no access to the flight controls (*Terry Panopalis*)



RB-66C-DT 55-(O)386 has a PACAF shield on its vertical stabiliser (and an unusual re-location of its fuselage national insignia), indicating service with the 11th TRS/67th TRW at Yokota from 1957. Following subsequent service with the 9th TRS/363rd TRW, the jet was converted to EB-66C configuration and flew in combat with the 355th TFW from 1969, before transferring to USAF's 36th TFW that same year. Moving to the 52nd TFW in 1971, the aircraft was serving with the wing's 39th TEWS when it crashed on take-off from Spangdahlem on 28 August 1972 as it departed for a *Creek Mule* reconnaissance flight along the East German border. The controls jammed, preventing the pilot, Maj Daniel Craven, from rotating the aircraft. He duly aborted the take-off and the crew of seven escaped from the burning wreckage (*Author's collection*)

could, however, be equipped with lightweight radar warning receivers and external chaff dispensers. Development of externally-carried jamming pods such as the QRC-160 finally commenced in 1957.

YOKOTA

The final 12 aircraft from RB-66C production (and an equal number of WB-66Ds for Wild Goose weather reconnaissance flights, which often became typhoon-hunting missions) went to the 11th TRS of the 67th TRW at Yokota AB, Japan, in June 1957 to operate alongside the 12th TRS's 24 RB-66Bs. These aircraft replaced venerable RB-26s.

Tactical reconnaissance missions in this highly sensitive Far East area were also undertaken by a wide variety of other types including RF-80A Shooting Stars, RF-84F Thunderflashes (until 1957), RF-86F Sabres, RF-100A Super Sabres, RB-57A Canberras and RB-45C Tornados, all controlled by either the 67th TRW or the 6021st Reconnaissance Squadron (Composite). The arrival of RB-66s for the 11th and 12th TRSs coincided with the 67th TRW's HQ moving to Yokota.

An adequate supply of newly trained 'Raven' electronic specialists to crew the aircraft took longer to arrive, as did the full complement of ECM equipment for each RB-66C. This in turn meant that the 11th TRS could not commence day and night (using the K-38 camera) classified operational missions over the Sea of Japan until mid-November 1957. Radar data that was subsequently acquired along the coasts of China, North Korea and the Soviet Union would be passed on to SAC HQ, which allocated much of the ELINT tasking in the area to the 55th Strategic Reconnaissance Wing's RB-47 Stratojet crews. SAC saw the RB-66s as competition for USAF funds.

The 67th TRW's huge area of responsibility extended over Japan, along the Demilitarized Zone (DMZ) between North and South Korea and coastal areas of China and the Soviet Union. Its resident KB-50 tanker unit, the 421st Aerial Refueling Squadron, was kept busy. Communist radar operators soon realised the RB-66's purpose and switched off their sets if one entered their area in daytime. Night operations in radio silence sometimes yielded better results. Drop tanks were also occasionally fitted, and the guns were retained as there were frequent interceptions by communist MiGs, the latter often closing to within 50 ft of RB-66Cs to photograph them.



The 11th TRS maintained a very good safety record, with no losses until 15 November 1958 when RB-66C 54-476 missed a landing approach at Yokota, turned sharply for a 'go around' and lost speed and altitude. Its wing dipped into the sea and the aircraft cart-wheeled into the water, killing the seven-man crew. RB-66C 54-0472 was also lost at sea while performing a go-around to land at Kunsan AB, South Korea, on 9 February 1959. The engines flamed out on approach, probably due to fuel mismanagement, and the aircraft ditched. Three 'Ravens' in the rear compartment perished. Fifteen RB-66Cs had been lost to accidents or combat by the time the sub-type made its final flight in January 1974.

There were more severe maintenance problems for the 12th TRS and its RB-66Bs which reduced availability to less than three aircraft several times in 1957. On 18 July that year 54-428 experienced loss of control and electrical failure during a navigational flight from Yokota. Capt George Slover was unable to pull the aircraft out of a stall and his three-man crew ejected safely at 18,000 ft. Two other aircraft were badly damaged in landing accidents.

The 12th TRS was inactivated in March 1960 as part of USAF force reduction programmes after less than three years with RB-66Bs. As an unforeseen prelude to the Vietnam conflict, two of its RB-66Bs had visited Bangkok in April 1958 to participate in Southeast Asia Treaty Organization reconnaissance exercises that included flights over Vietnam and along the Cambodian border. The unit's RB-66Bs were placed in storage at Davis-Monthan AFB, Arizona, in January 1960 following an Operation *Flying Fish* KC-135-supported flight back to the USA. After six years of inactivity, the 12th TRS received RF-4Cs at Bergstrom AFB, Texas. It subsequently became one of the most active RF-4C units of the Vietnam War.

Surviving 11th TRS RB-66Cs were transferred to the 363rd TRW at Shaw, while ten of Shaw's RB-66Cs (most of them only five years old) were

RB-66B-DL 53-481 saw service with the 4411th CCTG at Shaw AFB until it was placed in storage at the MASDC in June 1964. It returned to flying as an NB-66B shortly thereafter and was used at NAS El Centro, California, to test high-altitude parachute drops for NASA space programmes. The 20 mm guns (absent from this aircraft's tail turret) were usually locked in position until the gunner freed them and activated the charging switch (USAF)

also placed in storage and subsequently scrapped – a decision that would be seriously regretted when the Vietnam War began. ELINT duties in the PACAF area then reverted to SAC's similarly equipped RB-47Es, as they had better mapping capability and were expected to stay in service longer than the RB-66Cs.

RECCE DESTROYERS

Shaw AFB was home to the 363rd TRG (re-named a TRW from February 1958) with its 9th, 16th, 41st and 43rd TRSs, which began to receive RB-66Bs on 31 January 1956 and 12 RB-66Cs on 11 May that same year. By May 1959, the 41st and 43rd TRSs had been inactivated, leaving the 9th and 16th TRSs as the wing's only RB-66B operators. The latter squadron would remain equipped with RB/EB-66s at the base until 1974, the 9th having switched to RF-4Cs in 1966.

The first RB-66C for the chequer-tailed 9th TRS was named *City of Sumter* after Shaw's nearest city. The training programme for the type advanced satisfactorily, with a more favourable accident rate than many other units that were converting to jet types. Nevertheless, there were several mishaps with the RB-57As used for transition training. Its RB-66Cs also required modifications to their fuel systems to solve a centre of gravity problem with the forward fuel tank.

The 363rd TRW survived severe weather at Eielson AFB, Alaska, in October 1957 when successive deployments of seven RB-66Bs on four-month detachments without tankers were made. The wing also sent six RB-66Bs and three WB-66Ds (delivered early in 1957) to Incirlik as part of the CASF for Operation *Double Trouble* in September 1958. RB-66B 53-459 of the 41st TRS was lost en route after becoming disoriented due to a malfunctioning N1 compass. The pilot, Capt Clyde Trent, ditched the jet near a Norwegian freighter and he was recovered, together with navigator 1Lt Roth O Owen. Gunner A1C Julius Rausch was not found, however.

As noted in the previous chapter, three aircraft were damaged by small-arms fire whilst flying over Syria, Iraq and Lebanon during this first CASF combat deployment. The RB-66Cs committed to this operation came from Spangdahlem, rather than flying aircraft in from Shaw.

Similar deployments continued through 1961, including *Checkmate* exercises. The Shaw squadrons were also frequently called upon as NATO reinforcements in other situations such as the Soviets' closing of the Berlin air corridor in October 1961. For the resulting Operation *Stair Step*, the 9th TRS sent five RB-66Cs to protect the air routes into Europe for the massive reinforcements that the Air National Guard (ANG) flew in to increase USAFE's response to the crisis.

The RB-66 was one of the earliest USAF aircraft to adopt the British Flight Refuelling Ltd probe-and-drogue method from the design stage. At that time TAC had its own KB-29 and KB-50 tanker fleet, which used that system for fighters. After the converted bombers' retirement with severe airframe corrosion in 1964, TAC relied on SAC's KC-135As with their Flying Boom refuelling method, which required adaptation for probe-and-drogue use. The scarcity of suitably adapted tankers caused problems in later years. This RB-66C is taking on fuel from a KB-50 during a training mission over South Carolina (Terry Panopolis)





One of the vital ELINT tasks performed by the Destroyer in the early 1960s was gaining knowledge of the 'Fan Song' guidance radar for the SA-2 'Guideline' SAM, which had become a serious threat after one had shot down Gary Powers' high-flying U-2 in May 1960. EWOs' training was mostly against civilian or US Army radar sites, so they lacked experience of more sophisticated, mobile air defence radars. SA-2s were known to be based in East Germany, so the 42nd TRS, assisted by rotational pairs of EB-66Cs from the 9th TRS in *Swamp Fox* deployments every three months from 14 April 1960 through to early 1965, undertook many flights to identify and analyse the 'Fan Song' emissions. *Swamp Fox* exposed the 363rd TRW's trainee crews to the real thing, provided valuable preparation for wartime and enabled them to refine their plotting and signal analysis.

Their experience was helpful in October 1962 when 11 363rd TRW RB-66Bs and five RB-66Cs, forward deployed to MacDill AFB, Florida, detected 'Fan Song' and 'Fire Can' (AAA guidance radar) signals on Cuba whilst flying 'Red Lemon' reconnaissance missions during the Cuban Missile Crisis. Usually, all Soviet air defence radars on Cuba were shut down if a Destroyer was in the area. RB-66C crews detected and jammed several 'lock-ons' by Soviet air defence radars during the Crisis, and this operational experience would serve them well in the forthcoming duels with identical systems in Southeast Asia.

Meanwhile, the 16th TRS's RB-66Bs were required to provide night-time photography of potential targets. The 9th TRS, whose crews were on one-hour cockpit alert for much of the time, provided electronic monitoring of the island for three years after the Crisis had abated. In the same period the RB-66Bs were involved, with RF-101Cs, in the *Aunt Mary* monitoring programme that saw crews regularly taking photographs of Cuban terrain. During the whole Crisis period the 9th was also tasked with providing a courier service for film that was needed by government agencies.

At Shaw, the 363rd TRW gave the US Army Defense School a taste of frontline ECM operations, and its RB-66s frequently employed jammers and chaff during air defence training on long-distance penetration flights of the southern USA. 'Ravens' assigned to the RB-66C tended to work as regular teams, whilst pilots and navigators usually paired up, but seldom with the same 'Ravens'. EWOs were trained in RB-66Cs, with an instructor and three students seated in the small bomb-bay compartment.

Weather reconnaissance WB-66D-DTs were the last Destroyer variants to be accepted by the USAF, entering service from 1957. They also had the shortest service lives, with many of the 36 that were built being placed in storage from 1960. By the time Vietnam War requirements could have justified their conversion to ECM roles most had already been scrapped. Here, 55-401 of the 9th TRS/363rd TRW is seen receiving fuel from a KB-50 via its rear hose point in the tail (*Terry Panopolis*)

During Exercise *Sky Shield 2* in October 1961, when four RB-66Bs simulated SAC bomber attacks on cities in the southern states, they demonstrated that effective use of chaff could ward off interceptions by Air Defense Command (ADC) fighters. In one case, an RB-66B was theoretically shot down after running out of chaff during the fighters' 25th attempt to lock air-to-air missiles onto it. Visits to train ADC pilots at Tyndall AFB, Florida, also took place in Project *Big Blast*, RB-66 'Ravens' familiarising fighter crews with the effects of ECM on their interception and ground control radars.

With the introduction of RF-4Cs, accelerated by the impending needs of the conflict in Vietnam, the 16th TRS passed its RB-66Bs to the 9th TRS (which sent its WB-66Ds into storage) and converted to RF-4Cs from January 1965. The 9th continued to play an important role in US training exercises, including the first of the massive *Cold Fire* joint service ventures in October 1964 that required 13 RB-66s as part of the specially assembled 4487th Composite Reconnaissance Squadron operating from McConnell AFB, Kansas, and NAS Memphis, Tennessee. On 1 October 1965 the 9th TRS RB-66 assets were absorbed into the newly formed 41st TRS, formed on paper at Shaw. In mid-1966 the 9th TRS converted to RF-4Cs.

VIETNAM CALLS

Training requirements at Shaw were expanded and reorganised to meet the needs of the war in Vietnam. The 363rd TRW took over all EWO training from the 4411th Combat Crew Training Group (CCTG) in 1966, the wing duly doubling the total number of trained crews to 96 annually. The 4417th CCTS had 14 aircraft to prepare crews for Vietnam and USAFE operations and train a sufficient number of qualified 'Ravens' to eradicate a shortage in their number, all without the benefit of an EWO flight simulator. However, a paucity of aircraft – a constant problem throughout the B-66's career – often meant that only two or three jets were available for both RB-66C flightcrew and EWO training. No other RB-66 variant was suitable.

Repeated requests for more conversions of stored RB-66Bs as jammer-equipped ECM aircraft were refused on cost grounds until the batch of 52 EB-66Es was finally converted and entered wartime service in 1967. The long delays were partly due to fears that these conversions might jeopardise funding for the RF-111A, which TAC had chosen as an RB-66 replacement. During the Vietnam War, a substantial amount of continuation training had to take place within the combat units, which prepared EWOs for combat whilst also conducting operational missions. As crews normally flew one-year tours, the supply of new crews had to be maintained, but with great difficulty.

The 19th TRS, ejected from France in 1966, returned to Shaw and became the RB-66 replacement training unit as the 19th TEWS until its deactivation in August 1970. Development work was also needed to equip the RB-66s for war and Shaw's 4416th Test Squadron (later, CCTS) tested additional ECM devices from July 1966, including QRC-160 (ALQ-71) pods developed in conjunction with Douglas's Tulsa Division and carried



on pylons under the wings. An MA-3 stores adapter was fitted to the pylons that allowed up to three pods to be mounted on each pylon, all tuned to different frequencies. A further EB-66B unit, the 39th Tactical Electronic Warfare Training Squadron (TEWTS), was established at Shaw as late as 1969 to accelerate the supply of qualified crews.

USAF units began to withdraw from Southeast Asia from 1969, and there was hope that more EB-66s would become available for the 363rd TRW. However, in October 1970, the demands of the Ho Chi Minh Trail operations in Laos and Cambodia took seven of Shaw's aircraft to the 42nd TEWS at Korat Royal Thai Air Force Base (RTAFB), forcing the 39th TEWTS to compress its EWO training programme by cutting out the airborne sections. Four more Shaw EB-66s were needed at Korat from March to June 1971, and upon their return they were supplemented by five from deep maintenance at the Tulsa depot.

Meanwhile, as Shaw continued to plan for the long-anticipated phase-out of the Destroyer, preceded by the end of crew training in 1972, the EB-66Cs' service life was extended once again. By November 1971 more aircraft were deployed to support B-52 *Linebacker* operations, and that commitment increased throughout 1972, rapidly depleting Shaw's units. Its last EB-66C went off to war, together with eight EB-66Es, in April 1972, and EWO training was suspended and transferred to the operational units in Thailand.

Shaw's considerable aircraft availability problems were exacerbated by the severe deep corrosion found in many airframes, particularly those which had been exposed to the humidity of Southeast Asia. While the 363rd's maintainers were used to scavenging smaller parts from aircraft in desert storage, they now had to source entire redundant airframes from Davis-Monthan and re-equip them for service use. Some had to be given more thorough restoration at Tulsa, while the unusable airframes were salvaged. The EB-66 was still TAC's only operational ELINT collector and jammer, so the surviving aircraft had to be kept airworthy until the end of hostilities in Southeast Asia. The last EB-66C at Shaw was retired on 15 March 1974.

RB-66B-DL 53-(0)415 was serving with the 4417th CCTS/363rd TRW when it crashed near Kinston, North Carolina, during a night refuelling training mission as 'Flaw 61' on 24 June 1969. After disconnecting from the tanker, the aircraft yawed slightly and about 30 gallons of fuel spray entered the starboard engine. Seeping into the engine's 'hot' section through a ten-inch crack in the compressor case, the fuel exploded. The engine and pylon were torn away, ripping off the rear section of the fuselage and sending the aircraft into an inverted spin. Although instructor pilot Maj Edwin Welch managed to eject, he was killed when he fell 40 ft from a tree in which his parachute had become entangled (USAF)



CHAPTER FOUR

INTO THE FIRE

Destroyers, including this RB-66C-DT, received camouflage from 1966. The aircraft's ELINT systems required 36 horn antennas, some in fibreglass wingtip pods and others in a 'farm' beneath the fuselage, giving full 360-degree coverage. The jammer controls, originally in the gunner's cockpit position, were moved to the four-man EWO compartment in the centre fuselage (Terry Panopalis)

When USAF aerial losses in Vietnam began in August 1964, retirement of the B-66 was still in progress. The first US strikes on North Vietnam in Operation *Flaming Dart* took place in February 1965, and Operation *Rolling Thunder* intensified those attacks from 2 March onwards. By 4 April six F-105 Thunderchiefs had been shot down, and it became clear that adequate electronic reconnaissance and countermeasures to support strikes on North Vietnam were sadly lacking. SAC refused requests for coverage by RB-47H electronic reconnaissance aircraft, considering that such a small 'skirmish' did not warrant sophisticated support.

In early 1964 North Vietnam's defences were basic, with around 1500 guns, 20 early warning radars and four SON-4 gun-control radars – the latter increased the effective range of a 57 mm S-60 anti-aircraft gun from 12,000 ft to 18,000 ft. The first MiG-17s did not reach the Vietnamese People's Air Force (VPAF) until August 1964, and they entered combat from April 1965. When Hanoi was allowed, in November 1964, to acquire Soviet SA-2 missiles and its first SAM regiment was duly formed in January 1965, the situation became urgent. Between 31 August 1964 and early 1967, the number of fire control and early warning radars confirmed in North Vietnam by intelligence sources increased from six to 450.

The RB-66 was the only tactical aircraft that could offer ELINT flights in the area. USAF had its handful of *Brown Cradle* B-66Bs and,

fortunately, there were still 51 potentially convertible RB-66Bs sitting in desert storage. Because the Yokota RB-66C unit – the only one in the Far East – had been inactivated some years earlier, the 363rd TRW was ordered to deploy four RB-66Bs from Det 1 of the 41st TRS and two RB-66Cs with Big Sail ECM updates to Southeast Asia on 6 April 1965. These were followed by four more RB-66Cs from Det 1 of the 9th TRS. They were the only RB-66s available for deployment.

The first batch of 9th TRS aircraft from Shaw flew a 36.5 hrs (flying time) transit to Tan Son Nhut AB near Saigon, via Hawaii and Guam, arriving by 9 April 1965. Six of TAC's 23 available RB-66Cs were at Tan Son Nhut by May 1965, and combat missions began on 4 May. Three weeks later they moved to Takhli RTAFB in Thailand. Two more RB-66Cs arrived on 19 April 1965, and they began radar monitoring missions over North Vietnam to provide a database of the constantly changing electronic environment in order to support strike and reconnaissance missions. Over the following two years the RB-66s would provide the majority of the information on the operation of the SA-2's associated radar systems, with many 'Raven' crews being well versed in the black arts of ELINT thanks to their experience with USAFE and with the 363rd TRW in the USA during the Cuban Missile Crisis.

All aircraft had ECM tails in place of guns. Three of the RB-66Bs also had a Texas Instruments strobe light system installed in their bomb-bays for night photography. Although it worked in test flights down to an altitude of 500 ft, this system was not used in Vietnam as the requisite low altitudes put the aircraft well within range of multiple small-arms weapons. M-123 photoflash cartridges were used instead for night photography, with tactical missions flown at around 5000 ft from Tan Son Nhut.

The three strobe-equipped aircraft also had an AN/AAS-18 IR mapping and photography set as employed by RF-4 Phantom IIs and RB-57Es. Initially this equipment, operated by the gunner, was used on RB-66B *Moonglow* missions at around 2000 ft (mainly over South Vietnam) to detect the charcoal cooking fires widely used by the Viet Cong. They gave a distinctive IR image, and their detection enabled the Army to direct artillery fire at the source after such imagery had been processed. The four RB-66Bs flew two missions a day, often at very low altitudes, to secure detailed photographs, but they attracted small-arms fire. Later, in November 1965, RB-66Bs together with RB-57Es flew a concentrated series of sorties to identify cooking fires and other heat sources for targeting purposes.

PARTNERS IN ECM

For early *Rolling Thunder* F-105 strike packages from 17 April to July 1965, the US Marine Corps' VMCJ-1, commanded by Lt Col Otis Corman, provided ECM cover with its EF-10B Skyknights from Da Nang AB. Equipped with signal receivers and analysers, the veteran two-seat 'Willy the Whale' EF-10B suffered from inadequate power from its two 3400-lb thrust J34 turbojets. The aircraft's ECM fit consisted of two spot jamming transmitters, with an external pod for four noise and deception jammers and a chaff dispenser. With that extra (*text continues on page 43*)

COLOUR PLATES

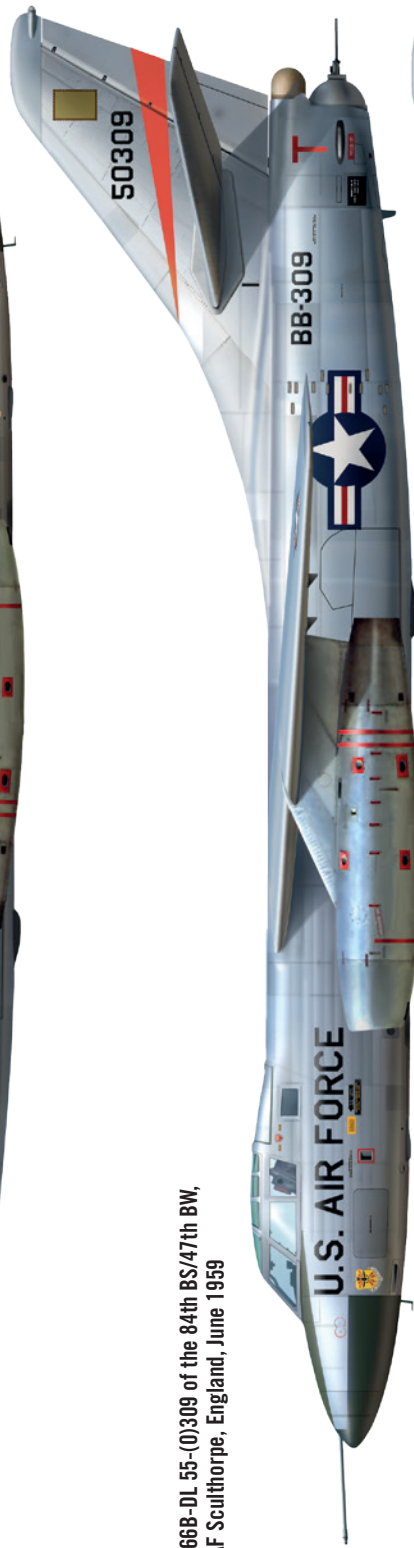
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B-66B-DL 55-(0)311 of the 85th BS/47th BW,
RAF Sculthorpe, England, 1960



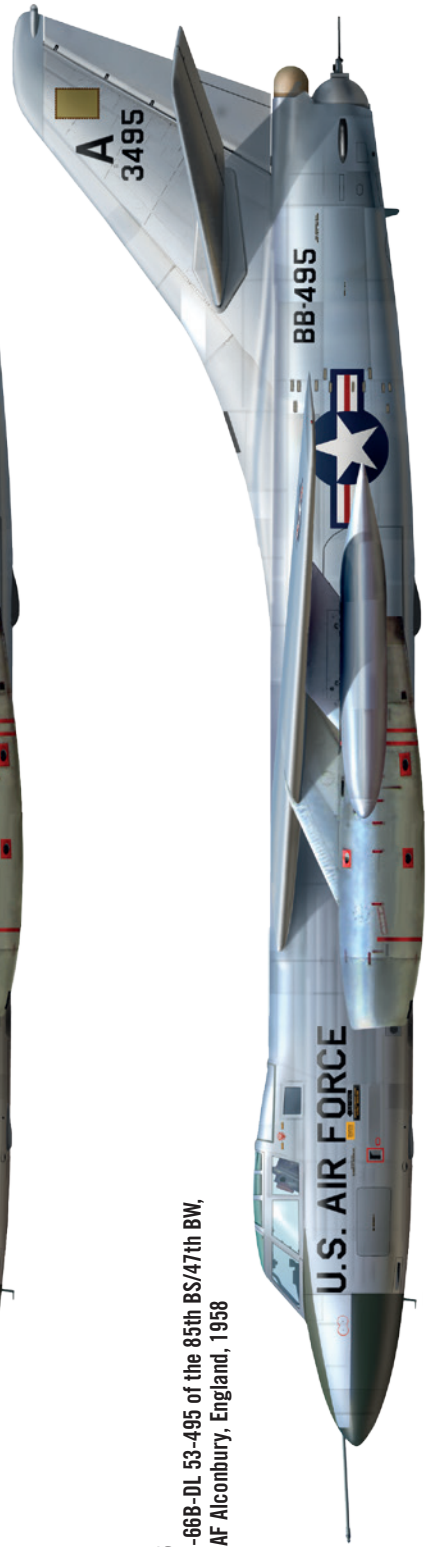
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B-66B-DL 55-(0)309 of the 84th BS/47th BW,
RAF Sculthorpe, England, June 1959



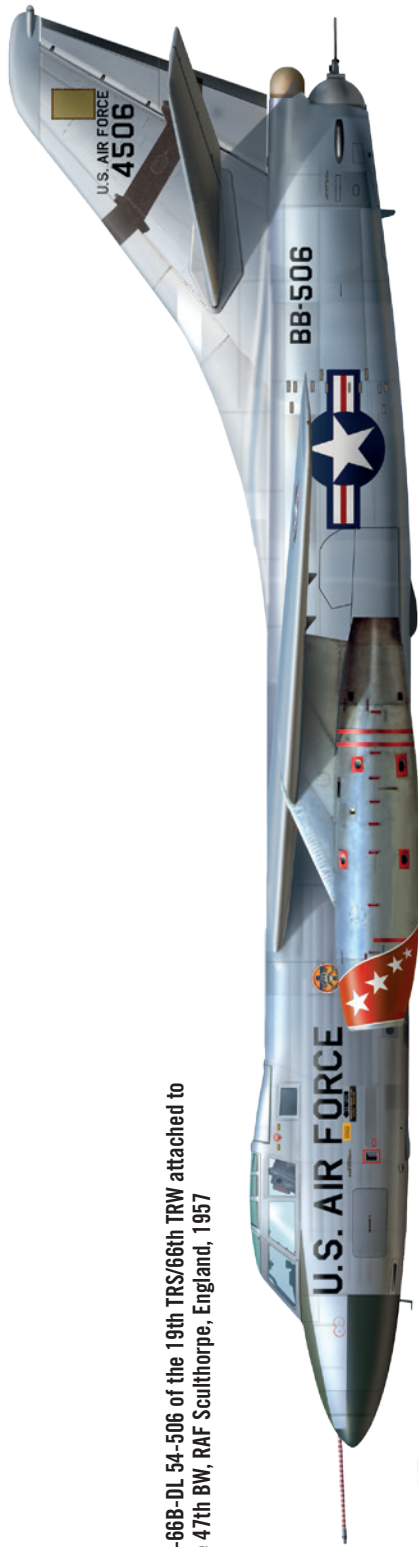
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B-66B-DL 53-495 of the 85th BS/47th BW,
RAF Alconbury, England, 1958



4

RB-66B-DL 54-506 of the 19th TRS/66th TRW attached to the 47th BW, RAF Sculthorpe, England, 1957



5

RB-66B-DL 53-0429 of the 16th TRS/363rd TRW, Shaw AFB, South Carolina, 1959



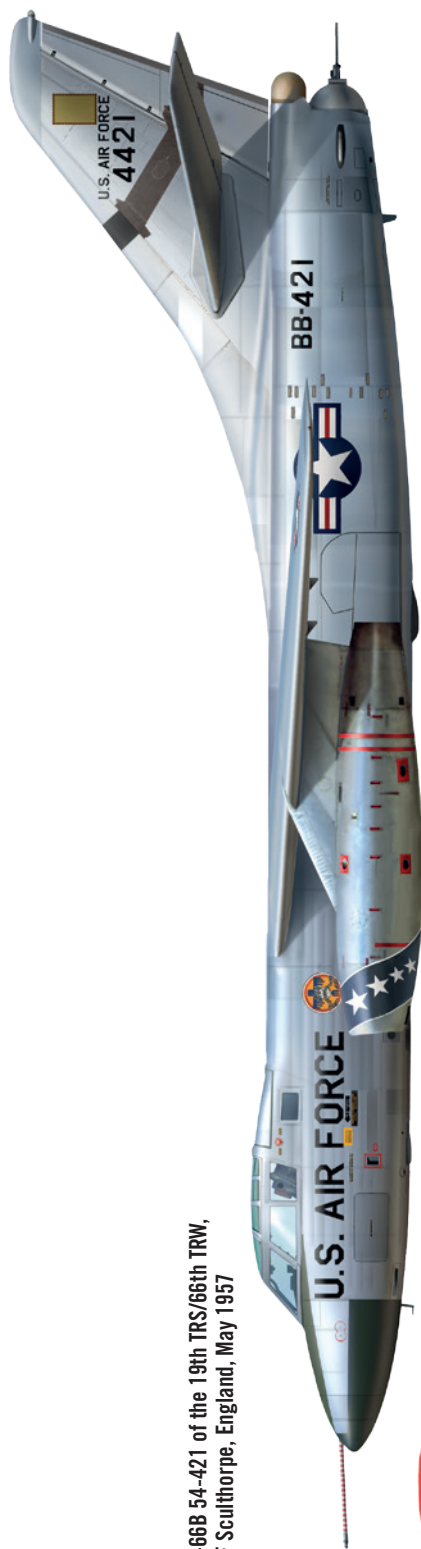
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RB-66B-DL 53-0415 of the 9th TRS/363rd TRW, Takhli RTAFB, Thailand, 1965



7

RB-66B 54-421 of the 19th TRS/66th TRW,
RAF Sculthorpe, England, May 1957



8

RB-66B-DL 54-(O)528 of the 30th TRS/10th TRW,
RAF Alconbury, England, 1960



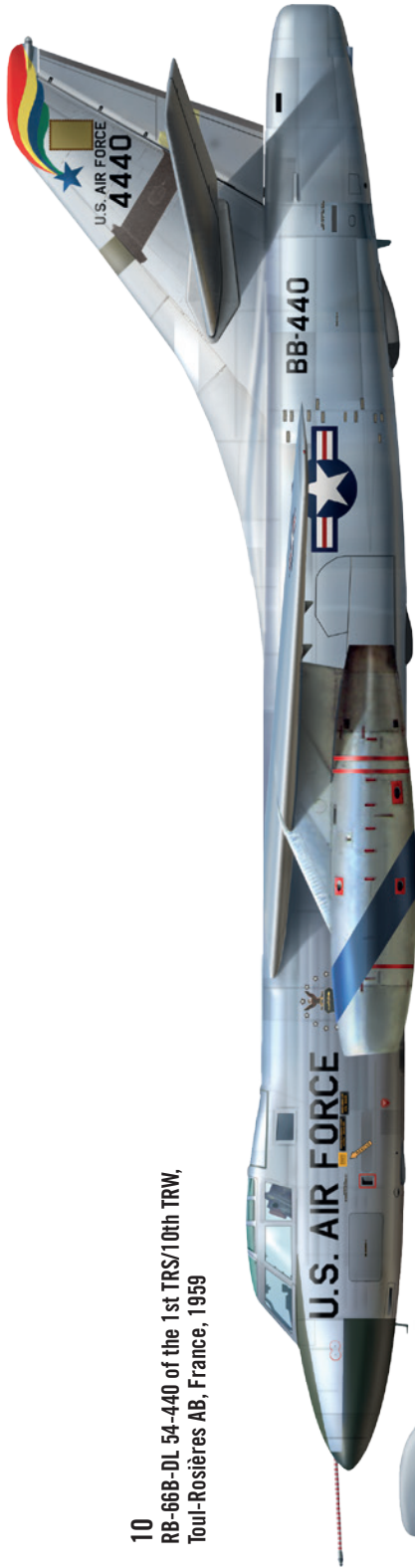
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RB-66B-DL 54-529 of the 10th TRW, Toul-Rosières
AB, France, 1964



10

RB-66B-DL 54-440 of the 1st TRS/10th TRW,
Toul-Rosières AB, France, 1959



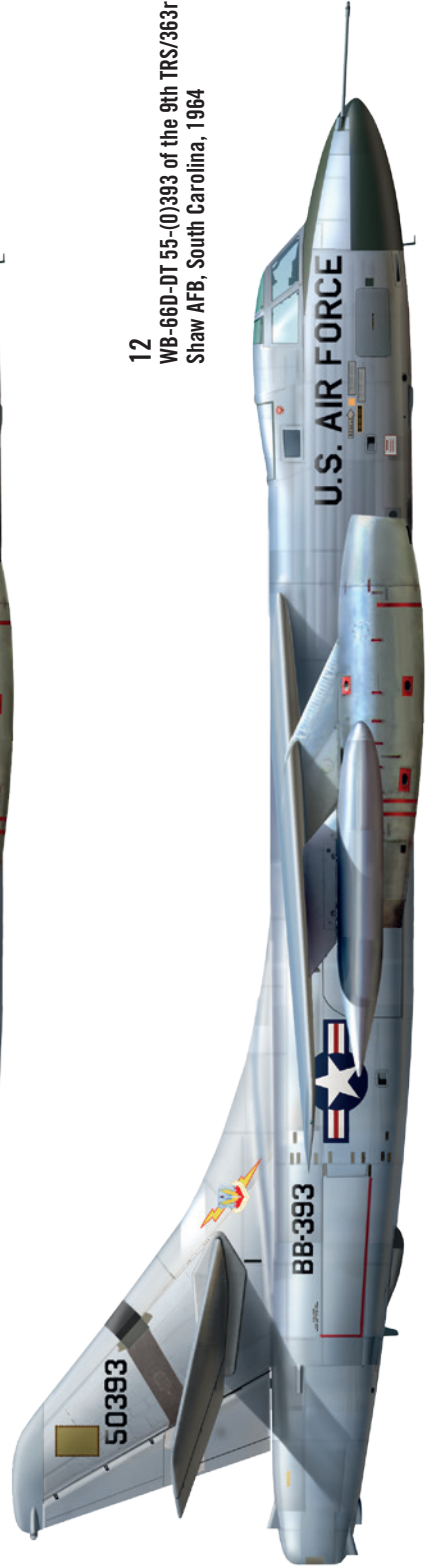
11

WB-66D-DT 55-402 of the 9th TRS/363rd TRG,
Shaw AFB, South Carolina, 1961



12

WB-66D-DT 55-(0)393 of the 9th TRS/363rd TRG,
Shaw AFB, South Carolina, 1964



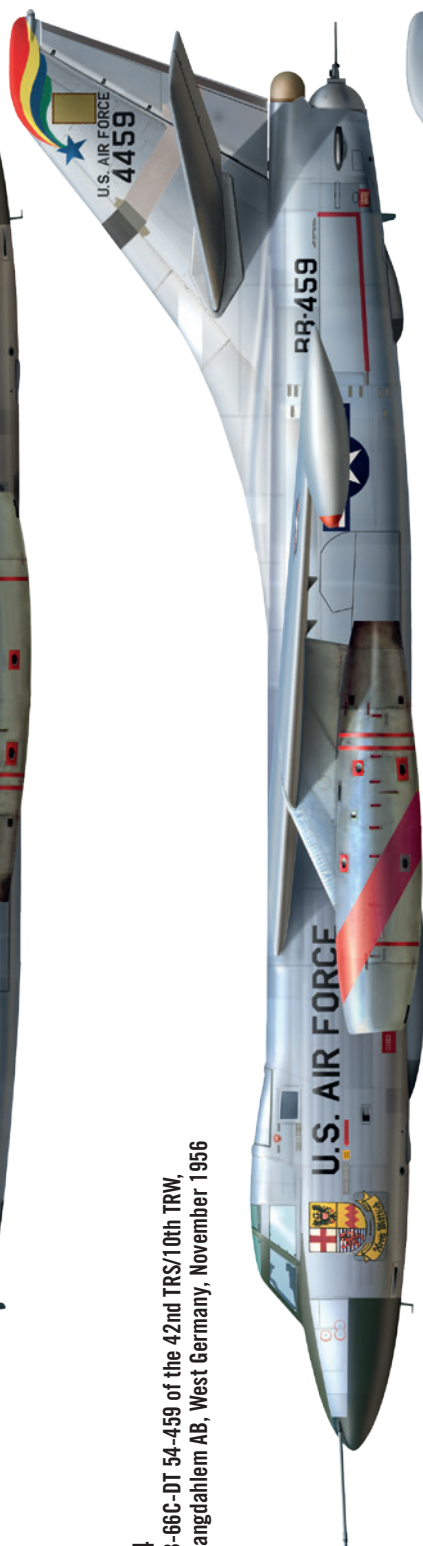
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NB-66B-DL 53-(0)488 of the 6511th Test Group (Parachute), Aerospace Recovery Facility, National Parachute Test Range, NAS El Centro, California, March 1962



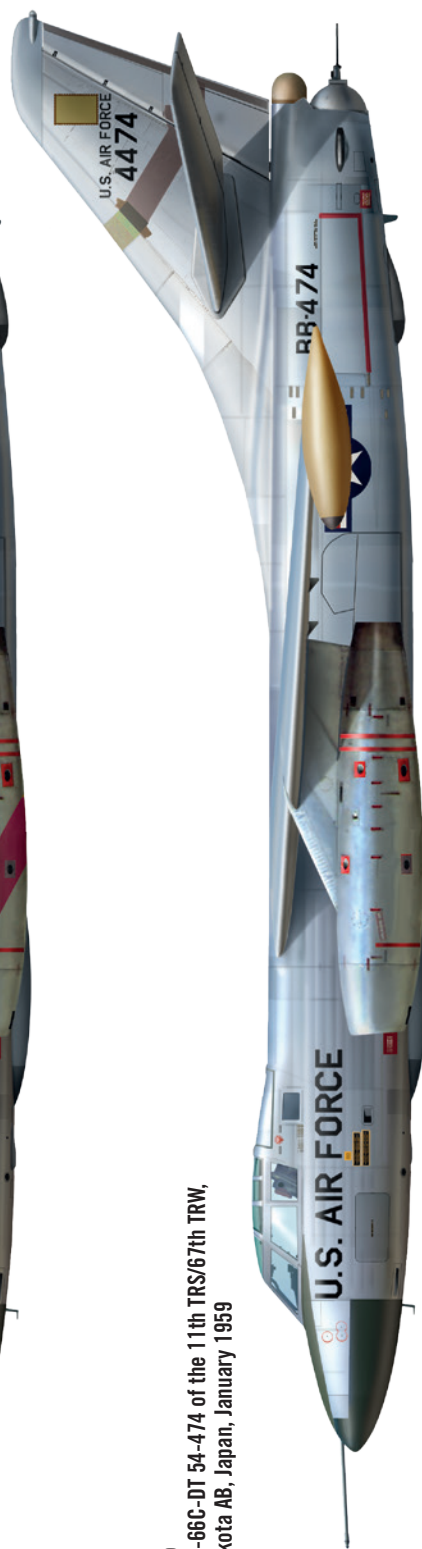
14

RB-66C-DT 54-459 of the 42nd TRS/10th TRW, Spangdahlem AB, West Germany, November 1956



15

RB-66C-DT 54-474 of the 11th TRS/67th TRW, Yokota AB, Japan, January 1959



16

RB-66C-DT 54-452 of the 9th TRS/363rd TRG,
Shaw AFB, South Carolina, 1958



17

EB-66C-DT 54-469 of the 42nd TEWS/355th TFW,
Takhli RTAFB, Thailand, March 1970



18

EB-66C-DT 54-469 of the 39th TEWTS/363rd TRW,
Shaw AFB, South Carolina, March 1972



19

EB-66C-DT 55-385 of the 41st TEWS/355th TFW,
Takhli RTAFB, Thailand, 1969



20

EB-66C-DL 54-459 of the 39th TEWS/36th TFW,
Spangdahlem AB, West Germany, 1970



21

EB-66E-DL 54-446 of the 19th TEWS/363rd TRW,
Shaw AFB, South Carolina, April 1968



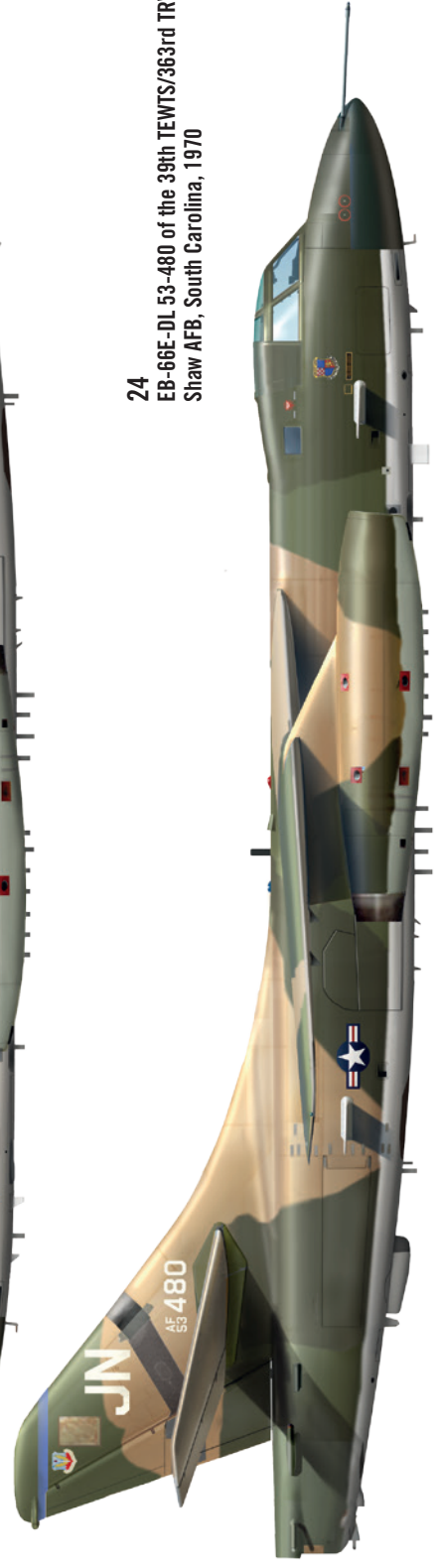
22
EB-66E-DL 54-443 of the 42nd TEWS/388th TFW,
Korat RTAFB, Thailand, January 1971



23
EB-66E-DL 53-479 of the 42nd TEWS/388th TFW,
Korat RTAFB, Thailand, 1972



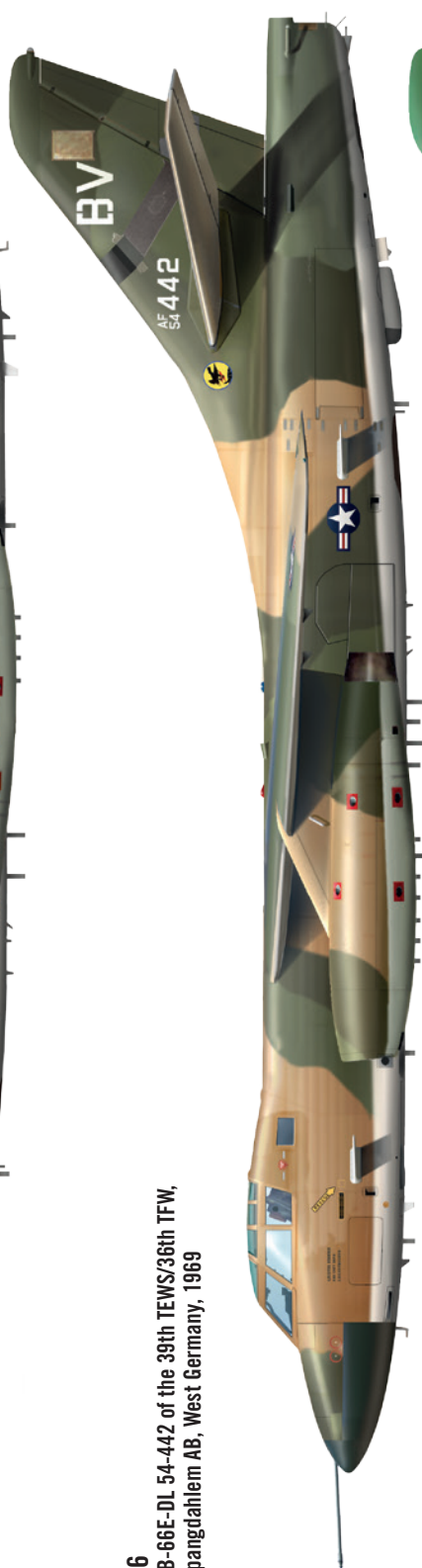
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EB-66E-DL 53-480 of the 39th TEWTS/363rd TRW,
Shaw AFB, South Carolina, 1970



25
EB-66E-DL 54-527 of the 41st TEWS/355th TFW,
Takhli RTAFB, Thailand, February 1968



26
EB-66E-DL 54-442 of the 39th TEWS/36th TFW,
Spangdahlem AB, West Germany, 1969



27
EB-66E-DL 54-531 of the 39th TEWS/52nd TFW,
Spangdahlem AB, West Germany, 1971



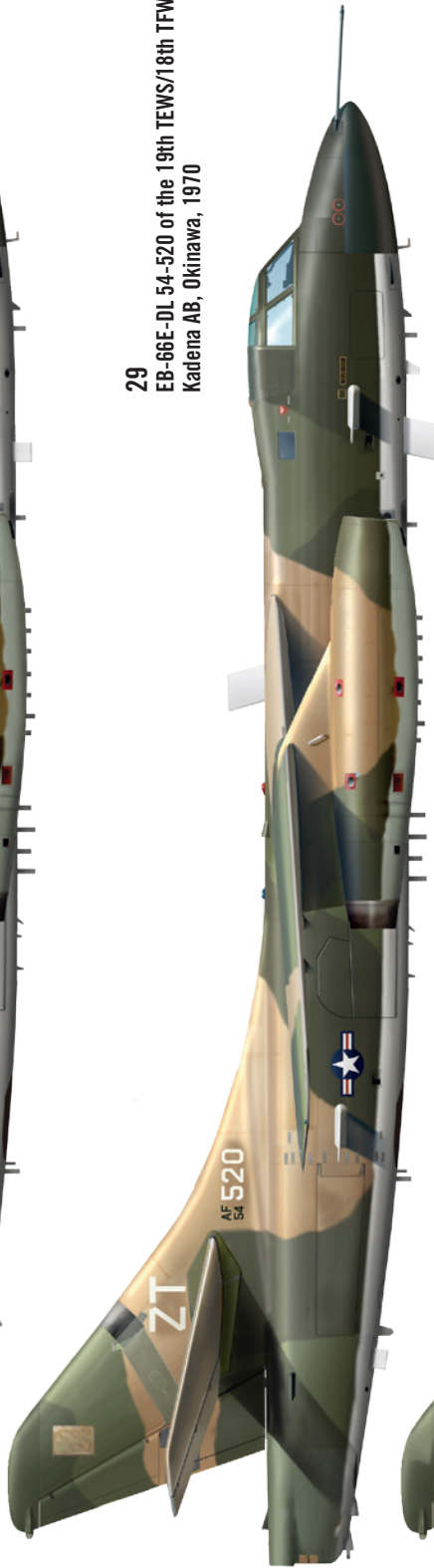
28

EB-66E-DL 54-442 of the 39th TEWTS/363rd TRW,
Shaw AFB, South Carolina, 1971



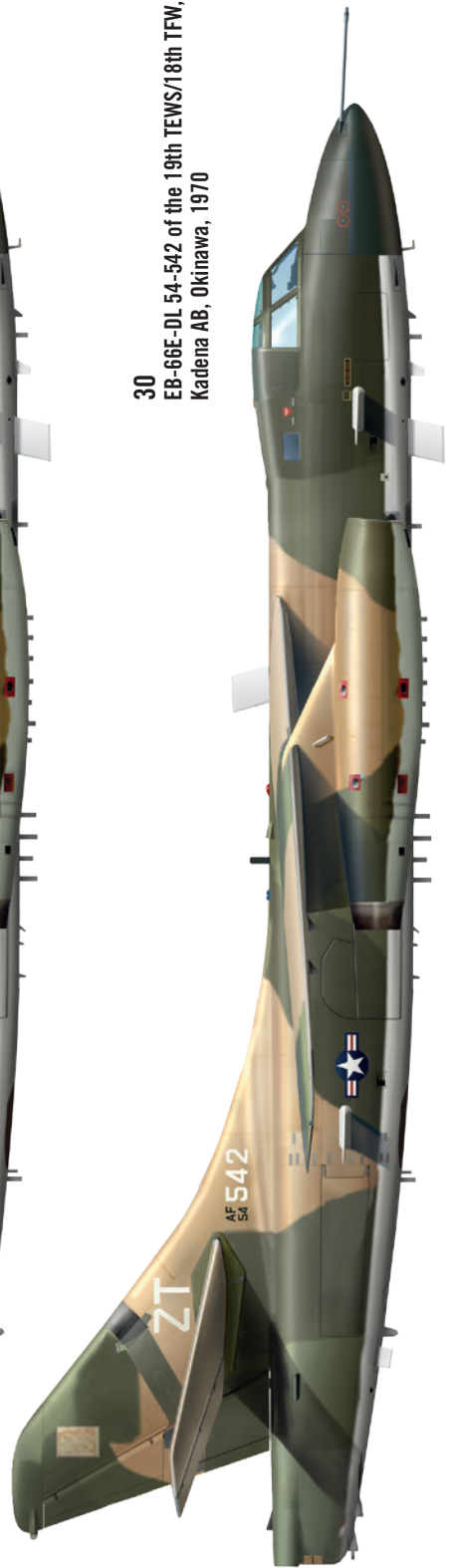
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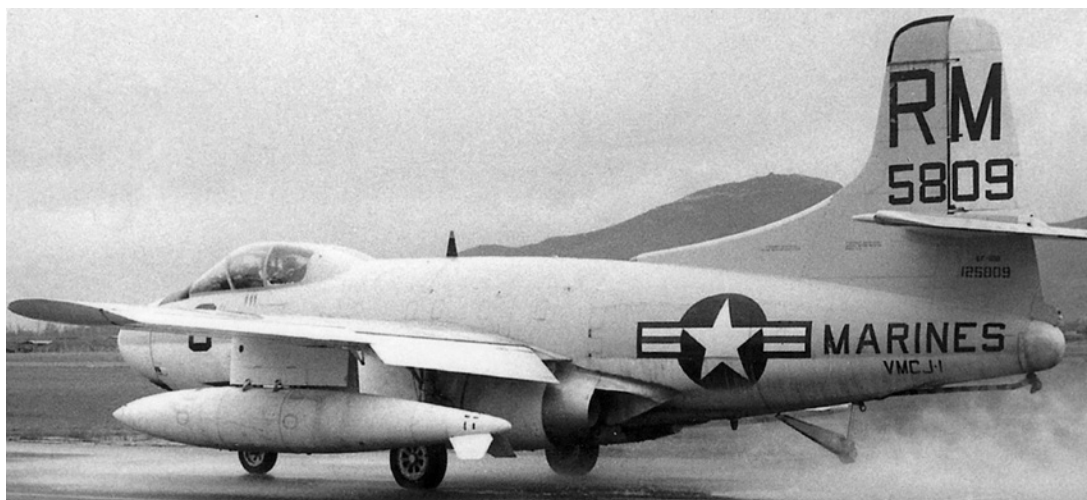
EB-66E-DL 54-520 of the 19th TEWS/18th TFW,
Kadena AB, Okinawa, 1970



30

EB-66E-DL 54-542 of the 19th TEWS/18th TFW,
Kadena AB, Okinawa, 1970





With a piercing shriek from its two 3400 lb thrust J34 engines, EF-10B BuNo 125809 of composite squadron VMCJ-1 commences its take off run from Da Nang at the start of one of the unit's 791 *Rolling Thunder* EW support missions – a duty it shared with RB/EB-66 squadrons – in 1965. With the addition of a 300-gallon external fuel tank, the EF-10B's on-station time in an offshore orbit was only 50 minutes at 250 mph, and the external stores' drag severely compromised its already marginal performance. Nevertheless, VMCJ-1 Skyknights maintained all-night coverage from 1800 hrs through to 0600 hrs for targets in North Vietnam (*US Navy*)

weight, including an external fuel tank under one wing, the aircraft needed the full length of Da Nang's 10,500 ft runway for take-off and struggled to reach its 30,000 ft operating altitude and 345 mph cruising speed. Nevertheless, EF-10Bs provided crucial ELINT and ECM assistance (codenamed *Fogbound*), with six jets flying 791 *Rolling Thunder* ECM support missions during 1965.

The aircrafts' jamming range was limited to around 16 miles from their offshore 'perch' at 30,000 ft. Neutralising a 'Fan Song' or 'Fire Can' required four EF-10Bs to fly a circular orbit over land at 20-25,000 ft with the radar at its centre, and this quickly became a prohibitively dangerous tactic. EF-10Bs were particularly effective in preventing 'Fire Cans' from directing the big 57 mm, 85 mm and 100 mm AAA guns. Although EB-66s provided some ECM support for attacks on SA-2 sites in March 1966, the EF-10Bs flew most of these missions – 85 in total. After *Rolling Thunder*, the 'Whales' undertook many night jamming missions against 'Fan Songs', even in terrible weather. Often, crews would orbit over the sea near an F-105 strike at 290 mph and within range of SAMs for up to three hours while the EWO sought out 'Fan Song B' signals on his scope.

Luckily the 'Fan Song B' was the only variant of the SA-2 radar (apart from 'Fan Song F', modified for optical tracking) that the EF-10Bs and RB-66s had to deal with in eight years of operations. From 1961, Soviet forces had the 'Fan Song C' and 'E' working on shorter wavelengths and giving better resolution of the target for their superior SA-3 'Goa' missiles, which were much more resistant to ECM than the SA-2. These were not supplied to North Vietnam, as Moscow feared that China would copy the missile, as it had done with other Soviet military hardware.

North Vietnam's defenders quickly realised that their radars were being jammed by EF-10Bs and RB-66s orbiting out of range of the AAA, their efforts giving strike aircraft a better chance of surviving the hostile airspace around Hanoi and Haiphong. This soon made the unarmed EW aircraft primary targets for the North Vietnamese, who were also well aware of the small numbers of EB-66s available to PACAF. From October 1965, the increasing defences meant that EF-10Bs had to orbit too far from their

targets for their jamming to be effective – a problem which the RB-66 crews would also encounter in due course. They continued in service until 1970.

The US Navy's few EA-1F Skyraiders provided ECM cover for its early *Rolling Thunder* missions, patrolling offshore ahead of the strike force. They were used until 1968, but much of the ECM for the US Navy's 'Dr Pepper' Alpha strikes in Route Pack 6 around Hanoi and Haiphong came from EB-66s. Takhli-based EB-66s would fly north of the Demilitarized Zone (DMZ) and take up positions off Haiphong. US Navy strikes then had to coincide with their 'on station' times, which were usually at 1000 hrs, 1400 hrs or 1600 hrs ('ten, two and four' in the words of the Dr Pepper commercial). RB-66 jamming allowed the strikers only a narrow approach corridor, so the jets always came in along the same route and at predictable times, making the AAA gunners' jobs easier. By July 1967, these constraints, and the US Navy's doubts about how effective the jamming really was, ended the RB-66s' participation in the strikes.

THUNDER ROLLS ON

RB-66s operating from Takhli soon established tactics to support *Rolling Thunder* strikes. As Gen William Momyer, the Seventh Air Force commander in charge of *Rolling Thunder*, commented;

'EB-66s were positioned on the outer limits of the 30-mile restricted area [around Hanoi] to cover the approach to the target and the withdrawal route. By being so close to the major target area, these EB-66s could provide effective blocking of acquisition radars. Two EB-66s in the northwest quadrant and two in the southeast quadrant provided, in effect, a jamming beam into and out of Hanoi for the F-105s.'

The demands on the small Destroyer force rapidly increased to the point where some crews were flying three missions a day by August 1965, allowing them to rapidly build up their mission totals. Capt Eldon 'Joe' Canady flew his first mission as an EB-66C 'Raven' on 4 May 1965, and completed his 100th by December, even though he had had to return to the USA for several weeks during that time. He often flew two missions over North Vietnam per day, and in November 1965 Canady completed 27 flights over the North. By February 1966 he was passing on his experience as a 363rd TRW instructor.

As Destroyer crews completed their tours after 100 missions (and often well within a year), shortages in replacement personnel increased. This in turn meant that much of the real hands-on training had to be done at the EB/RB-66s' operational Thai base. By 1967, 75 per cent of Takhli's EWOs were entering combat straight from EW training. Operational experience amongst new pilots was just as limited, which meant that their first five missions had to be flown in the lower risk areas of Vietnam.

Missions took them over much of North Vietnam with the strike aircraft, although at higher altitudes and not within the prohibited zones around Hanoi and Haiphong, or the 20-mile exclusion zone along the Chinese border. For F-105 strikes, two EB-66Cs orbited along the approach route to the target and the egress route, monitoring and jamming any radars that 'came up' to challenge the fighter-bombers, particularly during the seven to ten minutes that they were heading directly for their target.

RB-66s entered the outer regions of the target area before the strikers, having had first call on the tanker force. Operating as pairs, they flew elliptical orbits beyond the range of AAA, warning the strike force of threats and jamming them. RB-66s could only focus on one radar at a time, however. Trying to deal with a series of radars with overlapping 'Fan Song' coverage, which the North Vietnamese integrated air defence system provided, was beyond their capabilities and put them at risk. Their noise jamming was most effective when the strike force was operating between the jammer and the enemy radar, on the same axis.

Ryan Firebee reconnaissance drones were also flown into radar-rich environments in an attempt to trigger early warning or anti-aircraft radars so that their transmissions could be studied by RB-66 'Ravens'. On 23 July 1965 new signals were detected tracking the F-105s as they left the target. The 'Ravens' in an RB-66C recognised them as 'Fan Song' emissions from two SA-2 Dvina ('Guideline') SAM sites near Hanoi, and recorded their characteristics and locations. An earlier RB-66C flight had identified the 'Spoon Rest' target acquisition radar associated with an SA-2 site in the same area. Reconnaissance photographs taken on 5 April had shown the first SAM site for the 236th Missile Regiment under construction, and several were in place by July around Hanoi and Haiphong. Attacks on them were forbidden, however, as Soviet personnel were known to be involved in the work, giving the missile troops three clear months to set up their sites and learn their craft.

The day after the first 'Fan Song' detection, a salvo of three SA-2s was fired by a Soviet SAM crew at the 'Leopard' MiGCAP flight of 47th TFS F-4Cs 40 miles west of Hanoi. The Phantom II crews were apparently unaware that SAM sites had been identified in the area they were flying over. A launch warning was issued by an RB-66C crew at 0805 hrs local time, and moments later a missile exploded close to F-4C 63-7599, forcing the crew to eject. Only the backseat WSO Capt Richard 'Pop' Keirn survived, pilot Capt Roscoe Fobair apparently dying in captivity. The other three Phantom IIs in the flight were also damaged by this first SA-2 attack. They saw an unfamiliar corkscrew smoke trail approaching at 2300 mph, but the few seconds they had for reaction and avoidance were nowhere near enough time.

In recognition of RB-66C crews' efforts to identify and issue warnings of the threat sites, the three 'Raven' crews who had flown the 24 July mission all received the Distinguished Flying Cross (DFC).

The importance of ECM was at last being given due recognition. The urge to retaliate was understandably strong, and permission was finally granted to attack the known SA-2 sites, Nos 6 and 7 near Hoa Lac air base. After the intelligence on the two confirmed sites was used to assemble a punitive strike on 27 July, a massive force of 48 F-105s was launched, supported by three EB-66Cs and six EF-10Bs. Five Thunderchiefs were shot down, with the loss of three pilots, and a sixth was lost in an attack on barracks nearby. Ironically, all were downed by AAA rather than SAMs, as the sites had been turned into flak traps to catch the F-105s while they made diving attacks within the range of numerous AAA guns. It soon became clear that, although the sites had been destroyed, one was filled with dummy missiles and decoy radars and the other was unoccupied.

The SAM's biggest threat had now become clear – it forced strike aircraft to operate below the missile's minimum effective altitude of 4000 ft, which left them well within range of the majority of North Vietnam's conventional AAA. Whereas F-105 pilots had previously attacked in 60-degree dives from 17,500 ft, they now had to approach at much lower altitudes and make a 'pop-up' manoeuvre before commencing their attack dives. Inevitably, this put them at more risk from AAA all the way to and from the target. Somewhat belatedly, the tactical electronic war had begun.

ELINT flights increased as more SAM sites were detected and the RB-66Cs were fully engaged in locating and analysing their radiation, although they had difficulty in measuring their distances from threat radars so that the site could be accurately mapped. Some lengthy calculations were needed, taking several bearings from the target site and allowing for aircraft speed and heading. If the 'Fan Song's' pulse repetition frequency doubled it was a sign that an SA-2 launch was imminent, and appropriate warnings were passed to the strike force as jamming began.

RB-66s accompanying tactical fighter strikes jammed 'Fire Can' AAA, E-Band 'Fan Song' and A-Band P-12 'Spoon Rest' acquisition radars for SA-2 missiles. The SA-2 system's full complement of radars ideally included the UHF P-15 'Flat Face' long-range search radar and E-Band PRV-11 height finding set. RB-66s found particular difficulty in jamming the massive, long-range E/F-Band P-35 'Bar Lock' ground-controlled interception (GCI) radar because it generated multiple beams. It could also 'see' USAF strike forces approaching 90 miles into Laos and project 180 miles out to sea to monitor US Navy Alpha strikes. 'Bar Lock' would then be used by ground controllers to vector MiGs towards the strikers.

During May 1965 RB-66C crews, whose aircraft had a longer range and a much greater variety of ECM equipment than the EF-10B, evolved effective escort tactics. The Destroyer would fly towards the target and back twice just before the fighters arrived, spreading chaff at intervals from 25,000 ft and using the on-board AN/ALT-28 jammers to blank out 'Fire Can' anti-aircraft S-Band radars. The crews could proudly state that no losses of RF-101C reconnaissance jets or F-105s to radar-directed AAA occurred while they were providing support. However, RB-66Cs lacked the speed to fly with the strike force, even at low altitudes, and this put them at greater risk of interception by fighters from the VPAF.

A 7 August 1966 mission demonstrated their success in 'Fire Can' suppression. Capt Stan Tippin and Lt Norman Kasch in RB-66C 54-470 were awarded the DFC for preventing radar-guided AAA from hitting F-105s and F-4s that were trying to stop the North Vietnamese from capturing a downed F-105F crew. Capts Ed Larson and Mike Gilroy were then rescued.

Long gaps between detecting hostile radar sites and seeking permission to attack them, based on photo-reconnaissance evidence, prompted the use of drones to try and 'bring up' radar sites so that they could be attacked by quick-reaction strike elements before their guns or missiles could be moved. On 31 August 1965 a concerted effort was made to identify and map SAM sites using two SAC Ryan Model 147D drones escorted by EB-66s and EF-10Bs and accompanied by an F-105 strike force. A SAC RB-47 offshore was able to record continuous 'Fan Song' transmissions

for almost an hour and a half, enabling the ECM aircraft to pinpoint three sites. A drone was shot down and the F-105s were diverted to bomb the sites, although they failed to find any. Clearly the drones were unable to give sufficiently accurate coordinates for use in an attack.

For early *Rolling Thunder* support missions lasting up to four hours from 0500 hrs, two RB-66Cs left Takhli, topped up from a KC-135A over northern Thailand and flew almost directly north to the Laotian border, before turning east towards Hanoi and rendezvousing with the strike force as close as possible to the target. They then established elliptical orbits at 30,000 to 36,000 ft for around an hour and performed similar 'Fire Can' jamming tactics to the EF-10B, while simultaneously checking for 'Fan Song' emissions and protecting both the F-105s and the RF-101Cs from Udorn RTAFB that followed each strike to provide BDA.

Each of the four RB-66C EWOs worked on a single frequency band, collecting details of the type and location of a number of signals per hour, although the manual methods used for location were not always very accurate. Newly discovered SA-2 sites had to be located and photographed so that they could be included as known threats on maps. This was made more difficult as the North Vietnamese Army (NVA) abandoned the visually distinctive 'star' pattern layout of its early SAM sites and became expert in camouflaging them.

FOOLING 'FAN SONG'

When EB-66Bs became available from October 1965, they worked together with RB-66Cs so that the former's jamming power did not degrade the latter's sensors. While the EB-66B crew laid down their jamming as close as 15 miles from a target, the EB-66C could carry out its signal analysis work beyond the 17-mile range of an SA-2, protected by the EB-66B's jammers.

By 1966 the ECM flights had to face up to 20 different types of radar, so three EB-66s were often needed, together with US Navy EA-3Bs flying offshore circuits. Between 5 June and 16 July 1968, EB-66Cs recorded 891 different hostile radar signals. Jamming by a pair of Destroyers could

seriously reduce the power of a 'Fan Song' but, at a distance, it was often insufficient to neutralise the radar completely. However, the overall effects were impressive. From April 1967 to June 1968 there were reports of 1821 SA-2 launches, but only 25 aircraft were downed by them.

In November 1965 RB-66s provided orientation flights for the small group of F-100F Super Sabres equipped with Vector radar homing and warning equipment and panoramic scanners to detect and pinpoint hostile radar signals and seek out SAM sites at close quarters. It was soon apparent that,

A 41st TRS EB-66C crew at Takhli in March 1966. A crew usually consisted of a pilot, navigator and four EWOs. A flight examiner pilot would sometimes be aboard also. The large blade antenna below the rescue placard was part of the jamming system, and it also appeared on EB-66Es (Terry Panopolis)



unlike these *Wild Weasel* F-100Fs, RB-66s could not penetrate as far into SA-2 or MiG threat areas. Operating at safe distances inevitably reduced the power of the EB-66s' jamming emissions, diminishing their overall effectiveness by 1966 as the numbers of radar emitters increased and their operators learned to switch frequencies to avoid detection.

The task of the strike force and its ECM support was made far harder by the US government's covert practice of providing the neutral Swiss government with details of the next day's targets in North Vietnam. Secretary of State Dean Rusk justified this policy by explaining that 'we didn't want to harm the North Vietnamese people'. This information was then passed on, with US permission, to Hanoi, whose defences could then be arranged accordingly to cause the maximum US casualties. A new 85 mm heavy AAA battery could be established and operational within six days, while mobile SA-2 batteries could be moved to new sites within a few hours.

The first Destroyer combat loss occurred during an IR reconnaissance mission when RB-66B 53-452, temporarily attached to Det 1 of the 41st TRS at Tan Son Nhut, crashed near Pleiku on the night of 22 October 1965 while turning onto a new heading. All three crew were lost and the wreckage was sighted on top of a mountain in poorly charted terrain the following day. The bodies of the crew could not be recovered and the cause of the accident was never established, although it was assumed that the aircraft had flown into the karst mountain at low altitude.

EB-66s supplied jamming support for one of the war's more unusual missions. For the *Carolina Moon* project in May 1965, 5000-lb bombs were to be dropped from a C-130 into the Song Ma River, floated downstream and exploded against the seemingly impregnable and very heavily defended Than Hoa Bridge. While EB-66s jammed the AAA radars, the bombs were delivered accurately, but with no visible results.

REINFORCEMENTS

Five *Brown Cradle* B-66Bs that had continued to serve at Chambley-Bussières within USAFE finally flew to Takhli as Det 1 of the 25th TRW in October 1965, arriving on the 19th following long *Flying Fish* transit flights with KC-135As. In January 1966 the *Brown Cradle* aircraft were re-designated more accurately as EB-66Bs, and they formed the 25th TRW's Det 2. In June 1966, after a temporary return to Chambley-Bussières by Det 2, the *Brown Cradles* joined the 6460th TRS/TEWS of the 460th TRW, which had been activated earlier that same month with RB-66Bs.

The remaining eight *Brown Cradle* aircraft from the deactivated 42nd TRS also arrived at Takhli in June 1966, and two additional EB-66Cs appeared in October for the 6460th TRS. One aircraft (54-475) was lost during a *Flying Fish* deployment on 20 August 1966 following major maintenance at Tulsa, pilot Capt Dwight Lindley reporting control problems 300 miles northeast of the staging point at Hickam, Hawaii. The aircraft fell behind its tanker and the second EB-66C, which was taking fuel from the KC-135A, before losing altitude and disappearing without a trace.



An EB-66 on the flexible hose extension to a KC-135A's refuelling boom over eastern Laos in 1967. For *Rolling Thunder* missions, the tankers took off from Takhli first, followed by the EB-66s and then the F-105s. En route to the target, the Destroyers jammed any enemy radars that 'came up' in order to obscure the size of the strike force. As the F-105s headed down 'Thud Ridge', the number of threat radar signals multiplied rapidly. Targets were often re-attacked the following day, increasing the risk from AAA and SAMs (Terry Panopalis)

As the North Vietnamese progressed in their development of an integrated air defence system, the range and interconnection of their air defence and ground control radars required increasingly sophisticated jamming techniques. Working together, SAM batteries and fighters sought to disrupt the US strike formations and at least force them to jettison their bombs.

A February 1969 USAF Project CHECO report described the ways in which North Vietnamese 'Radar, AAA and SAMs began to display a high degree of discipline. The three systems were fully integrated under an excellent command and control net which, of necessity, extended to the fighter force also. This was a methodical, high calibre, tight control, multi-directional defence development, and it is significant to note that what took seven years to set up in the Soviet Satellite bloc took but seven months [from April 1965 when the first SAM sites were photographed] in North Vietnam'. This process, obviously established over a much smaller area than the Soviet bloc, was virtually complete by the end of 1965. It provided command and control centres in Hanoi and Phuc Yen, and beyond US reach in China.

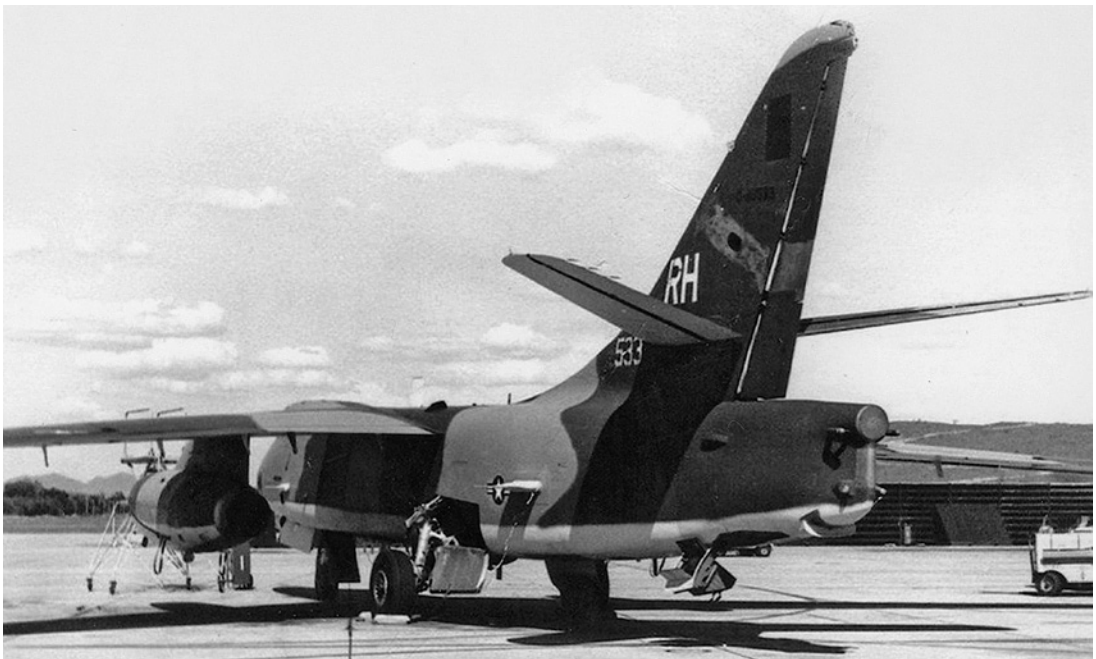
Sometimes, when the variety of threats overpowered the range of frequencies available to the 'Ravens' jammers, two EB-66s were insufficient for a mission. For example, when attacks on petrol, oil and lubricant depots around Haiphong began on 9 June 1966, four EB-66s were sent to support a strike by 34 F-105s and 24 F-4Cs. *Wild Weasel* F-105Fs, moving in closer to threat radars, had more success in combating 'Fire Can' AAA radars.

Working together, the various EW elements sought to attack all aspects of the enemy's air defences simultaneously, and the EB-66 force was kept busy offering a variety of functions in that endeavour. Its operational record from 1 April to 30 June 1968 shows that EB-66s flew 1299 sorties in support of tactical air strikes on North Vietnam, 175 *Tiny Tim* B-52 *Arc Light* escorts, nine missions supporting US Navy strikes and 258 EB-66C passive ELINT sorties. During the same period US Marine Corps EF-10Bs and EA-6A Intruders completed 626 ECM missions, although by that time the SA-2 threat meant that all 'Whale' sorties had to be flown offshore, reducing their jamming power.

Meanwhile, in a typically confusing flurry of re-designations, the 42nd TRS was revived at Takhli as the 42nd TEWS from December 1966, replacing the 6460th TRS within the 432nd TRW at Udorn RTAFB. In September the 41st TRS became the 41st TEWS and moved from the 460th TRW (headquartered at Tan Son Nhut) to the 432nd TRW, although it continued to receive maintenance and support at Takhli, home of the 355th TFW and its F-105s.

In August 1967 logic prevailed, and both the 41st and 42nd TEWS were attached to the 355th TFW at Takhli. Their operations were then made more efficient by the appointment of an EB-66 specialist, Col Harrison 'Ace' Lobdell, as deputy wing commander to manage both EB-66 squadrons. Like other respected commanders during the war, he led by example, flying many of the most challenging missions with the crews. The wing commander, Col John Giraudo, pointed out that the EB-66s in his wing were flying up to 600 combat sorties per month, often with less than 12 available aircraft. He insisted that the aircraft should be known as 'F-66s' in keeping with his other fighters. Giraudo also called his based SAC tankers 'F-135s'.

EB-66E-DL 54-533 of the 42nd TEWS/388th TFW displays the Mod 2259 revision to its tail cone. The upper section contained an AAQ-4 IR countermeasures set. The ALQ-18 antennas for the AN/ALT-6 jammers appear beside its circular endplate. Below that are the antennas for the AN/APR-25 and AN/APS-54 RWR and the AN/ALE-1 chaff dispenser – EB-66s were among the first US tactical aircraft to have inbuilt chaff dispensers. Ahead of that, the drag 'chute compartment door is hanging open (USAF)



MIXING WITH MiGs

F-104C Starfighters were initially provided as escorts for the EB-66s, and their MiG-killing potential was appreciated. However, their endurance was inadequate and they were soon replaced by F-4 Phantom IIs. Destroyer escort was never a popular mission due to the cruising speed differential between the aircraft. F-4 pilots always had to weave slowly behind the ECM aircraft, putting them at a disadvantage against a MiG-21 climbing or diving at supersonic speed into their rear quarter.

An early engagement with MiGs involved Chinese communist aircraft rather than the VPAF. During a 5 October 1965 strike on the Long Het ammunition depot by eight F-4Cs, five MiGs intercepted an EB-66C providing ECM support while orbiting in the northeast corner of North Vietnam just 17 miles from the Chinese border. The Destroyer pilot was sure that he saw Chinese markings on the fighters as they made two unsuccessful firing passes at his aircraft and then retreated northwards.

Escorting the crucial EB-66s, a prime target for communist fighters, led to another encounter near China on 12 May 1966. Maj Ray Dudley and 1Lt Imants Kringelis were 'Jupiter 03' in a 390th TFS/35th TFW F-4C Phantom II escorting 41st TRS EB-66C 55-387 20 miles from the Chinese border when four MiG-17s approached them. The EB-66 pilot, Lt Col Allen 'Spider' Webb, commander of the 41st TRS at Takhli, turned towards the MiGs, forcing them to break formation and fire randomly at the EB-66C.

One of the intercepting pilots was obviously determined to destroy the EB-66, and Dudley, although he was without a wingman, engaged the enemy fighter as it started to fire its 23 mm cannon at 55-387. Launching two AIM-9B Sidewinders, the Phantom II crew saw one of them blow the tail off the aggressively flown MiG. Dudley subsequently stated, 'I think I got two MiGs that day, but I was never given credit for the second one'. His F-4C, 64-0660, eventually became a triple MiG-17 killer.

The Chinese insisted that the downed fighter was one of theirs, claiming that five US jets had penetrated 25 miles inside their border and attacked several of their aircraft in 'a deliberate, systematic act of provocation by the Johnson government'. They also claimed that the EB-66 had been shot down by one of their J-6 (MiG-17) fighters, flown by Si Heng Zhu. The incident resulted in eight days of interrogation for the EB-66 crew in Saigon at the insistence of Defense Secretary Robert S McNamara, with hostile Press coverage. It was just one example of a border dispute that continued throughout the war, and cost several US aircraft. The RB-66C concerned also subsequently became a victim, being destroyed by a North Vietnamese SA-2 on 4 February 1967.

VPAF MiG-21s also regularly attempted EB-66 interceptions, with one such clash occurring on 23 April 1966 on the 'Thud Ridge' ECM orbit over the Tam Dao range 20 miles northwest of Hanoi. Two 'Denver' F-4Cs from the 555th TFS/8th TFW chased a pair of MiG-21s while the EB-66 pilot made his escape. They fired a total of six Sidewinders at the MiGs, but they all failed to guide correctly. Another F-4C escort mission on the same day led to some of the earliest MiG-17 kills, and started the 555th TFS on the road to becoming the 'largest distributor of MiG parts in Southeast Asia'. Two MiG-17s were downed on that occasion, and the

first USAF MiG-21 kill occurred three days later during an EB-66 escort by a 480th TFS/6252nd TFW F-4C crew. When three MiG-21s were detected attempting to hit the Destroyer with a head-on attack, F-4C pilot Maj Paul Gilmore advised his counterpart in the EB-66 to head for home. He then fired an AIM-9B at the VPAF fighter, causing its pilot to eject even though the missile had not made contact. Unaware of the MiG pilot's ejection, Gilmore finished the fighter off with a second Sidewinder.

MiG-21s again attempted to shoot down an EB-66C on 5 November 1966 during a strike force escort mission north of the Red River. The four escorting F-4Cs had been flying a weaving pattern on either side of the Destroyer, but as the aircraft slowed down in order to loiter near the target area they had had to fly S-shaped patterns vertically and horizontally so as to preserve their own speed and still stay with their charge. On radar, the F-4 crews could see that the MiGs would advance towards them when the EB-66C's orbit was inbound to Hanoi, only to retreat on the reverse leg of the pattern.

The Destroyer stuck rigidly to its jamming profile until the last F-105 flights had dropped their ordnance. It was then given the all-clear to exit the area. At that moment the EB-66C also received a warning from the *Red Crown* offshore air search radar-equipped US Navy warship that MiGs were approaching from 50 miles to the west, directly behind them. Their four-ship 'Opal' F-4C escort flight from the Da Nang-based 480th TFS/366th TFW was alerted, and 1Lt (later Col) Klaus Klause, in the back seat of 'Opal 02', explained to the author what happened next;

'We had an 'outrigger' formation of "Opal 03" and "04" above us at 27,000 ft, and we ["Opal" 02, F-4C 63-7535] were hanging about a mile from the EB-66's left wing, with "Opal 01" [Capt Jim "Friar" Tuck and 1Lt J J Rabeni in F-4C 63-7541] on its right wing. We were at about 25,000 ft, cruising at 0.72 Mach.

'I had picked up a radar contact at 18 miles and the EB-66C crew had picked up a coded indication of a MiG-21 radar, so they decided to turn back towards the northwest and leave. The first MiG-21 [in a pair from the 921st Fighter Regiment (FR), the jets being flown by Bui Dinh Kinh and Dong Van Song] came from our "deep six" in a 30-degree climb from low altitude. I called out, "There's a MiG down there" and Tuck called "I'm on him too". The lead MiG of the four that were out there closed with the EB-66, and I saw it launch a missile as Tuck called to the EB-66 pilot [Maj 'Kibby' Taylor, operations officer of the 41st TEWS] to break to the right.'

Maj Taylor made a violent 4g break at Mach 0.92. The R-3S (K-13A 'Atoll') fired by the MiG-21 missed, but the VPAF pilot followed the diving Destroyer. Klause continued;

'My "nose gunner" [pilot], 1Lt Joe Latham, jettisoned our three fuel tanks, but Tuck didn't lose his. I got the EB-66 on my radar as a big blip, followed by two smaller blips [the MiG-21 pursued by Tuck], and then at the end of this downward-spiralling daisy chain was another MiG-21 chasing "The Friar". I told Joe to lock on to this last MiG. We had the burners cooking so we ate up the two-mile distance from it. This silver MiG must have realised that we were behind him, for he entered a left-hand turn and pulled up. We were apparently at a range of 3000 ft so I said, "Hey, shoot!" As the MiG pulled up against a clear blue sky, we

hosed him with an AIM-9B Sidewinder. The missile came off the rail, jinked and exploded on him. The MiG looked as if it had just blown up and been punched over. We broke back left and almost ran over the pilot in his 'chute.

'Meanwhile, "Friar" Tuck had jumped on the lead MiG and fired two AIM-7E Sparrows, but they were just unguided rockets as he was inside minimum range. He was going pretty fast and was soon almost flying close formation alongside the MiG. However, its pilot still would not break off from the EB-66's "six o'clock", so Tuck practically shoulder-charged it to one side.'

Fortunately, Taylor was turning too hard in his EB-66C for the MiG to gain another firing position on him, and the VPAF pilot had to break off and try to re-engage from a different position. Taylor duly reversed his turn, diving to the left and descending to around 15,000 ft before he was able to escape into a cloud with all his jammers out of action due to the high-g manoeuvres. Klause concluded;

'Finally, the MiG broke away and dived, so Tuck fired another AIM-7E. It appeared to explode just ahead of the MiG, making its engine flame out, or maybe the pilot just lost control of it and ejected.'

Despite the fighter's demise, Taylor continued his evasive manoeuvring, levelling off at 10,000 ft and turning the somewhat over-strained EB-66C for Takhli. Destroyer pilots were subsequently informed in a TAC bulletin that the airframe 'might not be equal to the stress of the split-S and high-speed spiralling turns' of the customary SAM avoidance manoeuvre, which saw the aircraft immediately thrown into a full-power descent and turn. Taylor's EB-66C survived, however, and the crew later visited the 366th TFW at Da Nang for a celebration, during which they handed over an audio recording of the dogfight.

EB-66E-DL 54-435 displays its full antenna 'farm'. Most North Vietnamese radars were relatively unsophisticated, so Hanoi's Soviet advisors arranged them to provide overlapping coverage. Although they lacked resistance to jamming or ECM, the radars' variety of frequencies was some protection against EW aircraft that could only jam one radar at a time. EB-66s were most effective against low-frequency radars like 'Spoon Rest' and 'Knife Rest', or narrow-beam 'Side Net' units (USAF)

DUELLING WITH SAMs

Although AAA would account for around 80 per cent of US aerial losses in *Rolling Thunder*, the introduction of the SA-2 required the most challenging technical solutions even though the SAM caused only ten per cent of the losses. Its effect on strike missions was disproportionate to its success in actual engagements in that SA-2s forced incoming aircraft into



the range of innumerable AAA. There were 137 SAM sites to be monitored and challenged by the end of 1966, the year in which the EB-66 crews developed their most effective countermeasures.

On 25 February 1966 the Destroyer's comparative immunity came to an end. That day, 41st TRS EB-66C 54-457 (the first aircraft to be equipped with the AN/APR-25/26 radar homing and warning system) was flying at 30,000 ft as 'Gull 01' on a radar surveillance mission to try and locate a suspected new SAM site that was much further south than any previous sites. Five miles north of Vinh, a SAM rose from a Soviet-supervised site. The 'Ravens' on board detected strong 'Fan Song' signals while the SA-2 approached at Mach 3, and they advised the pilot to turn hard to try and break the missile's lock while the EWOs attempted to jam the missile. Moments later, an SA-2 exploded near the EB-66C, causing extensive damage to the radios and flying controls. Evasive manoeuvring prevented further damage from a second SA-2 when it exploded a moment later. Pilot Maj Robert Walker (who had previously served with the 19th TRW) was able to head out to sea, where six crew members ejected and were rescued by US Navy helicopters. Chief 'Raven', Capt John Causey, did not escape from the aircraft.

Further incidents occurred in which missiles damaged EB-66s without downing them. A *Brown Cradle* aircraft with the AN/APR-25/26 system detected a 'Fan Song' lock-on near Haiphong and the pilot made a SAM-avoidance turn, but fragments from the exploding missile damaged the starboard J71. The crew completed their mission on one engine.

The second 41st TRS RB/EB-66C loss that year came on 20 July 1966 deeper into North Vietnam in an area where SA-2s had not previously been encountered. Capt William Means, on his 89th mission over the North, was flying 54-464 'Devil 01' partnering a *Brown Cradle* Destroyer on an ELINT and jamming mission north of Thai Nguyen for an F-105 strike. He was turning in an orbit at 29,000 ft when two SA-2s approached undetected through heavy cloud cover and struck the aircraft. It staggered homeward for more than 50 miles, but the crew eventually had to eject near Phu An, where five were captured. EWO 1Lt Craig Norbert apparently died from burns.

The EB-66 orbits clearly had to be moved further from danger as SAM sites continued to appear outside the Hanoi-Haiphong areas. The orbit to the northwest of Hanoi was pushed further to the southwest, reducing the power of its transmissions. Seventh Air Force then decided to end F-4 escorts for EB-66s. VPAF fighter units soon took advantage of that opportunity to harass Destroyers and drive them into even more distant orbits where they were far less able to cover F-105s during the attack phases of their missions.

PODs

Although the EB-66 force had been a major component of the US electronic countermeasures effort in the early stages of *Rolling Thunder*, the provision of self-protection equipment for fighter-bombers within the strike force grew in importance as defences strengthened in North Vietnam. Increasingly heavy AAA and the proliferation of SAMs forced the less manoeuvrable jamming aircraft further away from targets, denying

the fighter-bombers powerful EW coverage when they were at their most vulnerable during their attack runs.

In an attempt to solve this problem, a Quick Reaction Capability (QRC) programme had resulted in the creation of the QRC-160-A-1 (later, AN/ALQ-71) pod for carriage by strike aircraft, giving them a degree of individual jamming protection against AAA radars and 'Fan Song' from late 1966. The overwhelming demand for the pods meant it took several months for the QRC-160 to become generally available.

Things had looked far less rosy for the pod in 1965, when the initial operational QRC-160 tests on a single RF-101C were unsuccessful due to inadequate tuning and maintenance of the devices and poor underwing pylon carriage arrangements. The pods were summarily dismissed by the commander of PACAF, Gen Hunter Harris, who considered them a time-wasting failure. EB-66s, therefore, had to continue as the main source of jamming for at least another six months.

However, ECM experts and, in particular, Lt Col David Zook of the 41st TEWS presided over Project *Problem Child* run by the USAF's Tactical Air Warfare Centre at Eglin AFB, Florida, to re-test the pods. After the initial rejection of the QRC-160, Zook commented that 'ECM had taken a real black eye'. Lt Col Ingwald 'Inky' Haugen, a retired USAF ECM expert, devised a carefully measured four-aircraft formation to maximise the pods' jamming effect and deny 'Fan Song' a specific target by blotting out its radar screen completely. 'Fan Song' operators would be unable to penetrate the electronic 'noise' to target individual aircraft and trigger the missile's proximity fuse. Tests at Eglin against the Soviet Air Defence System-1 indicated that there was only a four per cent chance of an SA-2 getting within 200 ft of a formation of four pod-carrying fighters.

Re-assigned to the 41st TEWS and RB-66Cs at Takhli in May 1966 (a time of particularly heavy F-105 losses), Lt Col Zook persuaded the CO of the 355th TFW, Col Robert R Scott, to test the pods in combat with his F-105s using Haugen's formation tactics as part of Project *Vampyrus*. The pods' behaviour would be monitored by RB-66Cs, whose crews would record the location, type and numbers of emitters revealed in the

RB/EB-66s were a vital part of F-105 strike packages until 1970, and they continued to work with F-105G *Wild Weasels* thereafter. EB-66B 53-496 is seen here in close formation with two F-105Ds before moving to its orbital position as the Thunderchiefs neared their target. F-105D 61-0139 (foreground) was lost in a fatal mid-air collision with F-105D 62-4240 while they were refuelling from a KC-135A over Laos on 3 August 1967 (Terry Panopalis)



target area, and their response to jamming by the pods. They also jammed frequencies not covered by the pods' emissions.

During subsequent missions, Zook, as Crew Leader 'Raven' in an EB-66C, was able to observe that the two pod-carrying Thunderchief flights received no damage, while others had been hit by SAMs and AAA. In 'Taksan' flight, the only two F-105s without functioning pods were subjected to attacks by MiGs, SA-2s and radar-guided AAA, although both survived.

Pods were ready for full operational use from October 1966 when QRC-160A-1s were supplied to the 355th and 388th TFWs for their F-105s. Col William Chairsell, CO of the 388th TFW at Korat, stated at the time that 'The introduction of the QRC-160-A-1 pod to the F-105 weapons system represents one of the most effective operational innovations I have ever encountered. Seldom has a technological advance of this nature so degraded an enemy's defensive posture. It has literally transformed the hostile air defence environment we once faced, to one in which we can operate with a latitude of permissibility'.

The last part of his comment was a fair indication of how bad things had been before the joint pod/EB-66 arrangement provided coverage all the way to the target. Overall, it was calculated that the loss rate without the QRC-160s would have been four times higher, although correct pod formation was key to their success.

EB-66s were still essential for stand-off protection of an entire strike force, however. In an F-105 attack on one of Hanoi's bridges on 15 January 1967, three of the 236th Missile Regiment's batteries encountered jamming patterns that they had never previously seen on their screens, produced by the combination of EB-66 and QRC-160 emissions. They were unable to launch any missiles and no F-105s were hit.

This remained the case until May, when the 63rd Missile Battalion realised that it could track targets to some extent by locking onto the source of the jamming ('track on jam'). It would then fire a barrage of missiles. The battalion's radar operators had devised a 'three-point' tracking method, using a 'Spoon Rest' acquisition radar rather than the 'Fan Song's' automatic detection and lock-on mode for most of the targeting sequence. This also bypassed the pods' jamming, which overloaded the 'Fan Song' if its own transmitter was working at full power. Losses increased again, with 113 F-105s being destroyed in 1967. From the 1966-67 losses, 18 were attributed to SA-2s. That figure declined to two in 1968, despite *Rolling Thunder* attacks continuing until the end of March.

A contributory factor in the dramatic reduction in losses to SAMs was the introduction of the upgraded QRC-160-8 (AN/ALQ-87), which could emit a wider range of varied jamming pulses. From December 1967, it could also jam the BGO-6 guidance signal sent to a beacon in the SA-2, which enabled the 'Fan Song B' operators to track and guide it to its target. QRC-160-A-1s were pre-set to jam known frequencies used by 'Fire Can' and 'Fan Song' and were most effective when used by four F-105s in a set 'pod' formation. They provided protection unless the flight passed within eight to ten miles of a 'Fan Song' or made a banking turn in formation, directing its pod radiation away from the threat. 'Fan Song' was then able to 'burn through' the jamming and 'see' the Thunderchiefs.

The defensive formation was seen as a real constraint by at least one F-105 pilot, whose comments were included in the USAF's Project Red Baron I survey, which was the first of three studies into air-to-air engagements in Southeast Asia;

'Pod formation is not a good look-out formation. It's the worst kind of formation you can fly. You have restricted visibility and restricted movement. If you have a MiG shooting at you it's dangerous to break from a pod formation. It also doesn't lend itself to mutual support.'

Attacks on Hanoi on 14 and 15 December 1967 by AN/ALQ-87-equipped F-105s yielded graphic proof of the need for both pods and EB-66 protection. Almost all the SA-2s launched by the 236th and 275th Missile Regiments failed to guide and went wild immediately after launch. Although North Vietnamese technicians continued to refine their guidance procedures, losses to SA-2s continued to decline throughout the war. By 1973, the missile's total 'kills' amounted to 107 aircraft in eight years, compared with 1625 to AAA. In 1968, the loss rate to SA-2s was reduced to 1.32 aircraft per 1000 combat sorties, from a 1965-66 peak of 5.53 per 1000.

JAMMING TECHNIQUES

EB-66B crews sometimes experienced interference with their RWR equipment in the form of electronic 'noise' from their own jammers – a problem which also afflicted F-105G *Wild Weasel* SAM suppression aircraft later in the war. For the EB-66 force, the solution lay in orbiting around 15 miles from the target, emitting their jamming barrier from positions over the Gulf of Tonkin or, preferably for the Thailand-based F-105 wings, near the start of the strike forces' typical approach routes along the 'Thud Ridge' mountain chain that led to Hanoi from the northwest. EB-66Cs could then operate beyond the range of the SAMs and detect their 'Fan Song' transmissions. They ensured that the EB-66Bs, which projected their jamming emissions along the 'Thud Ridge' route towards Hanoi, were aware of the threats and blocking the right frequencies.

The strength of their jamming transmissions was greatest as it extended outwards to either side of the EB-66Bs, requiring the aircraft to operate as a pair, with one jet always abeam of the enemy radar on the straight leg of its orbit. As the aircraft made a 180-degree turn at the end of the orbit, the strength of its jamming was reduced while the Destroyer was in a banking turn, directing its jamming signals far away from the target area and exposing the jet to 'Fan Song'. At that point chaff would be released to compensate for the reduction in jamming influence.

Ensuring the correct angle of bank for the turn in order to minimise the reduction in the EB-66Bs' jamming effectiveness required fine judgement by Destroyer and attacking B-52 and F-105 pilots alike – the latter relied heavily on blanket jamming at this critical point in the mission. Even a relatively shallow ten-degree turn could lessen the coverage appreciably.

According to Col John Fer, this was the reason that his 41st TEWS RB-66C 55-387 'Harpoon 01' was lost on 4 February 1967. He was established in an orbit at 32,000 ft, above the range of 57 mm AAA on an east-west racetrack northwest of the 'Thud Ridge' entry point for an

F-105 strike. An RB-66B jammer was 'stacked' below him at 30,000 ft and a flight of 555th TFS F-4s provided escort. The eastern end of the racetrack over Bac Can province north of Thai Nguyen took the RB-66C close to the Chinese buffer zone, and Fer was asked to extend that leg of the orbit a little longer while the chief 'Raven' checked out a radar that he had located. When the turn instruction was eventually given, Fer turned hard to avoid entering that 20-mile buffer zone. In so doing, the 60-degree angle of bank moved the jamming cone away from an unsuspected mobile SAM site below them.

Four SA-2s were fired at them by the 89th Missile Battalion. One hit the aircraft's belly, killing three 'Ravens'. The fourth, 1Lt John Davies, ejected downwards. John Fer and navigator Maj Jack Bomar also ejected, and all three were captured. Emphasising the importance of the EB-66s in Hanoi's estimation, 'Harpoon 01' had been hit by one of four SA-2 battalions of the 274th Missile Regiment that had been positioned northwest of Hanoi specifically to intercept the regular EB-66 orbits. North Vietnam's Air Defence Command regarded the shoot-down as its 'most significant achievement in the first quarter of 1967', and it claimed that the wreckage yielded many documents and extensive information on enemy electronic warfare. The 89th Missile Battalion was awarded the country's most valued unit citation, the Military Achievement Medal, First Class.

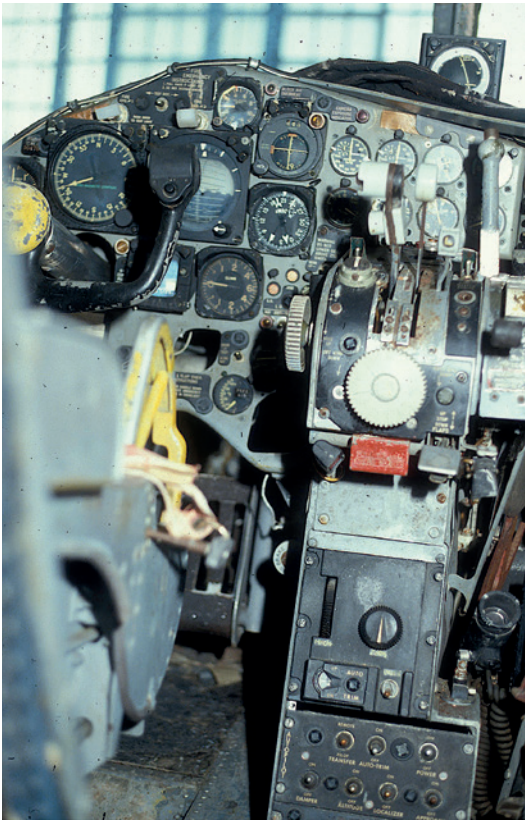
Attacks on specific SAM batteries were tried in 1967, using an EB-66C to direct the jamming of an EB-66B/E against a particular site so that it could be hit by strike aircraft without fear of retaliation from its missiles. Unfortunately, the heavy AAA defences around the sites were reinforced in response, so these attacks had to be curtailed.

The dwindling EB-66 force also received timely reinforcements during the course of 1967. At Davis-Monthan AFB, some surviving B-66Bs had been rescued from salvage and converted into EB-66Es so that the strike forces in Vietnam could continue to enjoy effective EW coverage and reduced losses. E-models had 21 jammers, mainly AN/ALT-6Bs, that were tuneable for different threats in flight, unlike 22 of the 23 jammers in the EB-66B which were pre-set on the ground. The B-model's one adjustable unit could be set to three different frequencies.

Inclusion of steerable antennas, as used in the EB-66C from around March 1968, to focus their emissions more precisely was denied on cost grounds as the modification would also have required new direction-finding equipment. Nevertheless, the reduction in the number of jammers to 21 allowed the available electrical power to increase the effectiveness of each unit. Adjustments to the jammers then became one of the topics in pre-mission briefings, together with timing of emissions, frequency changes and points at which chaff cartridges should be dispensed.

The first examples arrived at Takhli in August 1967, and they were rushed into operational service before crews had had time to integrate and test their jammers within the whole ECM tactics package – this would prove a source of difficulty for maintainers tasked with adjusting the units' pre-flight.

EB-66Es were particularly capable of denying the enemy early warning of air attack, and several practice missions, taking aircraft up to the North Vietnamese border, were flown to test enemy preparedness. EB-66E



The pilot's position on the left side of the RB-66B's cockpit provided him with a control yoke, flight instruments and throttles, which, unusually in a single-pilot aircraft, were operated with his right hand. Controls for the flaps, drag chute and autopilot were located on the same console. Absent from this aircraft is the AN/APR-25/26 radar homing and warning panel, which was subsequently mounted above the instrument panel coaming. Engine instruments are located above the throttle console (Terry Panopalis)

orbits were arranged as predictable packages, adjusted to suit particular types of aircraft or mission. On at least one F-105 mission – a strike on a North Vietnamese panhandle area target – an EB-66E over Laos and another over the Tonkin Gulf provided jamming that denied the enemy any early warning until the Thunderchiefs were just 20 miles from their objective.

By mid-1967, the EB-66 force could concentrate on jamming the enemy's GCI system and early warning and acquisition radars from a safer distance thanks to the increased number of pod-carrying F-105s providing their own jamming near the target. If EB-66s had been able to operate closer to Hanoi and Haiphong by day, they could have seriously disrupted the VPAF's very efficient ground control systems for directing MiGs into favourable interception positions. The communications that coordinated AAA and missile batteries to such deadly effect might also have been blinded by the B/EB-66Bs' AN/ALQ-59 or QRC-65 VHF communications jamming gear, considerably reducing US losses.

Unfortunately, that same equipment could also prevent EB-66s from hearing MiG warnings from EC-121 College Eye radar sentries, and impede radio contact with F-4 escorts. The long distances (at least 75 miles) of safe EB-66 orbits from MiG ground controllers meant that the 'Ravens' were also unable to

jam the identification, friend or foe gear in MiGs.

Jamming tactics, when seven or more EB-66s might be assigned to a mission, were in any case extremely effective in blinding radar sites and denying early warning of US attacks so that the defences could be alerted and organised. Their success caused serious concern to the North Vietnamese operators as they attempted to detect targets on their 'white-out' screens. Their food rations were increased to improve their vision and it was recommended that they wear dark glasses to combat the glare caused by jamming.

Comparatively large numbers of EB-66s were needed for many *Rolling Thunder* strikes. For the 18 December 1967 mission, five EB-66s set up jamming orbits at 30,000 ft offshore from Haiphong, while five more made chaff runs over northeast Laos and the western edges of North Vietnam, using parachute-retarded chaff packages to mask the approach of the F-105s from Thailand.

The EB-66's acquisition of radios that were less susceptible to jamming (including by their own emissions) meant that MiG warnings could be received more reliably from patrolling EC-121 aircraft or *Red Crown* off-shore radar ships. This, together with the North Vietnamese decision to pull back SAM batteries to locations nearer to Hanoi as US air strikes began to inflict greater damage on the military infrastructure, allowed EB-66s to move their orbits back to positions northwest of the 'Thud Ridge' route from October 1967.

MORE MiGs

The VPAF's determination to eliminate the highly disruptive effects of EB-66 jamming increased their efforts at interception. Air Defence Command gave the MiG-21 units a special 'non-combat mission', tasking them with developing tactics to attack EB-66s. MiG controllers soon began to direct MiG-21s towards EB-66 orbits, despite the fighter cover provided to the Destroyers.

On 19 November 1967, MiG-21 pilots Vu Ngoc Dinh (given special responsibility for EB-66 interception) and Nguyen Dang Kinh left Noi Bai air base to intercept a Destroyer near Than Hoa. The pilots split up, one attacking from a high 'perch' and the other from low altitude behind the EB-66. Kinh evaded the F-4 escort and fired two R-3S missiles at the ECM aircraft, claiming that he hit an engine and destroyed the EB-66. The missiles exploded below their target, however, and no loss was recorded by the Takhli wing that day as the pilot of the Destroyer had received a MiG warning from the F-4s in time to execute an evasive diving manoeuvre. The Phantom IIs then chased the fleeing MiG-21s but both escaped. Another attempted attack on an EB-66C the following day was also frustrated. After that, the ECM aircraft had to be pulled back again to positions south of the 21st parallel.

A less auspicious MiG-21 encounter occurred on 3 February 1968 when two 509th FIS F-102A Delta Daggers flew an EB-66 escort mission at 36,000 ft close to the North Vietnam-Laotian border near Sam Neua. Maj A L Lomax led 'Jersey White' flight, with 1Lt Wallace Wiggins as his wingman in F-102A 56-1166. At Noi Bai airfield in North Vietnam, 921st FR pilots Pham Thanh Ngan and Nguyen Van Coc (who would end the war as the top VPAF ace with nine kills) took off on their fourth interception mission of the day, heading for a pair of enemy aircraft that radar had picked up near Moc Chau.

Near the Laotian border Ngan thought he saw a distant EB-66, but at closer range he realised he was looking at the two F-102As. Lomax saw the MiGs, turned and launched three AIM-4D Falcon missiles, all of which missed. Ngan manoeuvred into Wiggins' blind spot and triggered an R-3S (K-13A 'Atoll') missile which refused to leave its launch rail, but his second missile impacted the F-102A's tail. Van Coc also fired an R-3S but it failed to guide. The MiG-21F-13s were then told to break off the engagement by their controller.

Wiggins reported handling problems with his aircraft, and when Lomax checked the Delta Dagger he saw an unexploded 'Atoll' protruding from its rear fuselage. Lomax attempted to locate the MiGs again but they had rapidly departed, and seconds later he saw Wiggins' aircraft explode, with no sign of an ejection.

The effectiveness of the USAF fighter protection was indicated by the loss of only one EB-66 to MiGs throughout the war, despite persistent efforts by the VPAF. It occurred over Laos, where EB-66Cs would provide up to 12 hours of radar surveillance daily in 1970-71 until tanker shortages forced them to reduce their commitment. MiGs were seldom a threat over Laos, with their solitary success occurring on 14 January 1968. 41st TEWS EB-66C 55-388 'Preview 01' was

intercepted at 28,000 ft during an ELINT mission involving five Destroyers 65 miles southwest of Hanoi near Route 15 on the Ho Chi Minh Trail in support of a strike near Than Hoa.

Two 921st FR MiG-21s flown by Nguyen Dang Kinh (who had claimed the EB-66 on 19 November 1967) and Dong Van Song were scrambled from Noi Bai air base and vectored towards the unescorted EB-66C. They detected the aircraft at a range of eight miles some 15 minutes into its orbit. Nguyen Dang Kinh fired his two R-3S IR-seeking missiles, but both failed to home correctly. Dong Van Song, who had already claimed three F-105s, then fired an 'Atoll'. His R-3S destroyed the EB-66C's right engine and wing. Maj Hugh 'Sonny' Mercer Jr turned towards safety, but the Destroyer entered a spin and he instructed his crew to bail out as they overflew mountainous country in North Vietnam.

Three of the crew landed a short distance apart. 1Lt Ron Lebert's parachute was suspended in a tree, and he hung there for 17 hours before being cut down by local troops and taken into captivity. A search and rescue (SAR) effort was immediately begun at Nhakon Phanom RTAFB, and aircraft contacted four survivors on their emergency radios. Darkness and bad weather delayed the rescue attempt until the following morning, when a SAR force led by 37th Aerospace Rescue and Recovery Squadron (ARRS) HH-3E 64-14233 headed out. The helicopter, flown by Capt Gregory Etzel, entered the karst mountain area with visibility of around 50 ft. Its rotor blades struck a mountainside as it attempted to cross a ridge and the helicopter crashed. Although the crew escaped with their lives, some had suffered severe injuries. They were now stranded on a steep slope 40 miles into enemy territory. Two more helicopters were sent in, but they were frustrated by bad visibility and one was damaged by machine gun fire.

On 17 January, three crew from the RB-66C were rescued by an HH-3. Lt Col James Thompson and instructor radar navigator Lt Col Attilio 'Pete' Pedroli, who had also landed in a tree on a mountain side but was able to lower himself to the ground, were recovered intact. Maj Mercer had sustained severe injuries when ejecting while the aircraft was spinning, including broken legs. He died in hospital three days later. The CIA attempted to insert a *Bright Light* covert rescue team to locate the remaining four crew and arrange a helicopter extraction, but they had apparently already been captured. Majs Thomas Sumpter and Irby Terrell, Capt Hubert Walker and 1Lt Lebert, three of them EB-66C EWOs, were imprisoned until March 1973. Pedroli returned to the 41st TEWS to complete his 100 missions.

This incident did not initially increase awareness in Saigon of the MiG threat, and a mission on 18 January on the same route was met by the same VPAF interception tactics. Fortunately, the crew evaded the MiG-21 and its missiles. Following the second engagement, the Seventh Air Force instructed that all EB-66s were to be removed from North Vietnamese airspace and given additional MiGCAP flights to protect them from VPAF fighters that were crossing into Laos to try and catch them. This arrangement remained in place until the end of *Rolling Thunder* on 2 November 1968.



CHAPTER FIVE

THUNDERING ON

In the words of USAF historian Bernard C Nalty, 'Throughout the *Rolling Thunder* campaign EB-66 jamming involved compromise between effective coverage and aircraft survival'. While RB/EB-66s flew with F-105 formations to provide jamming for early *Rolling Thunder* strikes and stand-off jamming when the defences became prohibitive, the detection and destruction of specific SAM sites became the responsibility of modified strike aircraft that could locate and attack the sites at close quarters. An EB-66 barrier between the strikers and enemy SAMs or AAA could protect the incoming force, but the enemy's defensive positions could be moved to deny the Destroyers their favourable barrier positions.

Lt Col David Zook recorded his impressions of a mid-1966 four-hour mission in support of an F-105 strike on a priority target near Hanoi, with F-4C combat air patrol (CAP) protection and post-strike reconnaissance by an RF-101C. It began with a briefing at 0430 hrs, before the tankers took off at 0500 hrs just before daybreak, followed by the EB-66s and then the F-105Ds. Zook was the leading EWO in a team of four;

'As we finished our refuelling we made our way across Laos, picking up dozens of early warning radar signals from North Vietnam. As we proceeded, we jammed the radars we encountered – not so much for our own protection but to deny the North Vietnamese a clear view of the attack force. A second RB-66C was flying to the south of the target area, while we were to the north of it. We knew the instant that the "Thuds"

EB-66E 54-542 displays the full antenna 'farm' that it received on conversion from RB-66 configuration in October 1967. EB-66Es had up to 130 external antennas, including a large white one under the forward fuselage for jamming communications. Photographed here in 363rd TRW markings, the aircraft ended its career with the 19th TEWS/18th TFW at Kadena in 1970. From the spring of 1966 RB-66s equipped for ECM were redesignated EB-66s (USAF)

were starting down “Thud Ridge” because of a sudden increase in radar signals on our scopes. The threat radars for the AAA and missiles were coming on regularly now.

‘I was broadcasting SAM warnings now, as were the other surveillance aircraft in the area. It was also clear that the *Wild Weasel* force was at work trying to keep the “Fan Song” radars from operating. The pitch of battle increased as we heard MiG calls and distress calls adding to the radio chatter. More and more emergency beepers could be heard. An F-4C flight leader was on the radio venting his disgust. We listened as he lined up on a MiG and had gotten into a firing position. There was a pause, followed by an expletive as he bemoaned the fact that he had failed to arm his air-to-air missiles.’

The EB-66C crew remained on station for 30 minutes, but then had to extend their jamming coverage for another hour until a replacement RF-101C had completed its work after the first one had been shot down before it reached the target. The second EB-66C, short of fuel, had to return to base.

‘Each minute seemed to last a lifetime as we continued our orbit’, Zook recalled. ‘I noticed that the early warning and search radars were still at work, and then I began to get a “Fan Song” signal on my RWR. It was to the west of us. We were still northwest of Hanoi. The “Fan Song” was only a weak “one ring” [on the warning scope] signal that came and went. As we turned to the southwest-bound leg of our racetrack orbit, the “Fan Song” came on strong and steady at our “two o’clock” position. It was a full three rings, and then it went to the edge of my scope. I put jammers on it and alerted the crew.’

EWO Capt Wimbrow then announced that he had a missile launch indication, and Lt Col Zook ‘called for a split-S manoeuvre to change heading and altitude quickly. I dispensed a bunch of chaff as we started our evasion. We dropped 4000 ft and ended up heading back to the northeast. We used this tactic often. Tom [Crowman, the pilot] would roll inverted and pull back on the stick to make a half-loop. Tom had seen one missile while we were inverted. As we rolled out we were faced with two new “Fan Song” signals, one coming from our “seven o’clock” and the second from our “three o’clock”. I got the jammers on these signals and advised the crew. I also issued a SAM warning, as it was time for the RF-101 to be making its run.

‘All of a sudden a bunch of “Fire Can” AAA radars came on, as well as a third “Fan Song”. Soon there was a missile launch signal. We were at the north end of our orbit again and Tom called back to ask for instructions. I asked for another split-S, as the RF-101 should have been exiting his photo run if he was still in one piece. We were now at about 28,000 ft and going about as fast as an RB-66 could go. Tom could see a lot of AAA below us and decided to stay at our new altitude. We headed mostly south, rather than risk heading back into the SAM that was west of us. We heard the RF-101 call RTB [returning to base] and we congratulated ourselves.’

With their fuel at emergency levels, the RB-66C crew diverted to Udorn and the engines shut down, starved of fuel, as the jet rolled out onto the taxiway. All six crew members were recommended for DFCs following this mission.

WEASEL PROGRESS

In November 1965 the relevant tactics for close-in detection and destruction of threat radars were pioneered by the small 6234th TFW F-100F Super Sabre *Wild Weasel* Task Force. They often 'trolled' for SA-2s, flying close to suspected SA-2 batteries to lure 'Fan Song' operators into a radar engagement so that US attack aircraft could be called in to hit the site. Occasionally, this tactic involved an EB-66C at high altitude making repeated passes over known SAM sites. One such flight in October 1966 required an EB-66C to overfly a SAM site for 15 minutes in the hope that it would reveal itself. An F-105 armed with an AGM-45 Shrike stand-off radar-homing missile was ready, but the wily 'Fan Song' crew did not fall for the ruse.

Weasel F-100Fs initially flew with the F-105s on SAM suppression (*Iron Hand*) missions over North Vietnam, finding the SAM sites, marking them with white phosphorus rockets and directing Thunderchiefs to attack them. They scored initial successes, but two of the four Super Sabres committed to this dangerous mission had been lost by April 1966 and it was decided that the faster two-seat F-105F should be used instead as the *Wild Weasel III*, similarly equipped to the F-100Fs but armed with AGM-45s.

In 1969 the F-105G *Wild Weasel IV* added the much larger, longer-range, AGM-78 Standard anti-radiation missile (ARM), which featured a 'memory' to keep a missile on track to its target even though the emitter had shut down. Shrikes would miss their target, however, if their radar lock was broken in flight, usually by the targeted radar switching off. Both missiles had a low success rate in destroying 'Fan Song' units, but their main effect was to force radar operators to shut down, thereby giving a strike force greater protection.

F-105Gs also carried their own QRC-335 noise-barrage jamming units. Eight F-105F *Combat Martin* aircraft also briefly had QRC-128 transmitters to jam enemy communications frequencies, although EB-66Es fitted with the same system had more success with it. Working with a US Marine Corps EA-6A ECM aircraft on 23 May 1968, they interfered with the ground control radio signals to a pair of 921st FR MiG-21s and prevented them from receiving warning of a surface-to-air missile launch by the cruiser USS *Long Beach* (CGN-9). A RIM-8 Talos hit Hoang Quang Hung's fighter at a range of 65 miles, forcing him to eject.

EB-66E-DL 54-445 of the 42nd TEWS/355th TFW at Takhli in November 1968. While on jacks for maintenance on 3 May 1973, the aircraft's engines were run at full power but the safety switches for the landing gear were incorrectly set. The aircraft suddenly ran forward over its chocks and its right wheel almost severed the leg of maintainer TSgt William Tompkins. After a 70-ft run, it collided with a concrete post. Tompkins' life was saved but the aircraft, although repairable, was written off and used for fire practice as phase-out was imminent (Terry Panopalis)





EB-66C-DT 54-470, an ex-10th TRW aircraft, was photographed at Takhli with the 42nd TEWS/355th TFW in 1970. The EB-66C was probably the most important Destroyer variant in Southeast Asia because it was the Seventh Air Force's only tactical aircraft capable of gathering electronic intelligence. Given the USAF's overall numbers committed to the conflict in Vietnam, it was ironic that the loss of a single EB-66C inflicted real damage on the operational and training commitments of an aircraft whose importance could not have been realised when the original order for only 36 examples was placed (*Neil Byrd*)

A similar action on 22 September again saw an EB-66E and an EA-6A jamming the GCI communications for two 921st FR MiGs that were beginning an interception of US strike aircraft over North Vietnam. A Talos from *Long Beach* downed one of the MiG-21s and damaged the second. Both pilots ejected, having presumably received no warning of the missile launch due to jamming by the EB-66E and EA-6A.

Jamming MiG GCI communications continued into the Operation *Linebacker* period in 1972, and success depended on the proximity of the EB-66 to the sources of the transmissions and the VPAF fighters' position relative to the jamming. Inevitably, trying to improve the strength of the jamming risked placing the aircraft closer to SA-2 batteries. Although much attention was given to jamming ground control radar units, it was also essential to avoid disrupting messages between US aircraft as well. EWOs were duly given a UHF code word to start QRC-128 jamming and another word to stop it.

Changes in 'Fan Song' emissions were noted in 1972, giving rise to rumours of an undetectable 'black SAM' with immunity to jamming. In fact, Soviet technicians had modified a 'Fan Song' to shift from its usual E-band frequency to I-band. Initially called T-8209, US ECM experts re-named the modification B-4272 Teamwork, and the jammers in EB-66s and other aircraft were suitably adjusted to deal with it.

Later that same year many 'Fire Can' radars were also given band-shifting capability, complicating the 'Raven's' tasks. However, 'Fire Can' (based on a World War 2 design by American manufacturer Westinghouse) remained more vulnerable to jamming than 'Fan Song' and other early-warning radars, and it was a primary focus of attention for an EB-66C crew. Once detected, an EB-66E could then aim jamming at the 'Fire Can'. If early warning or acquisition radars could also be jammed, the 'Fan Song' and 'Fire Can' crews had to use their radars to acquire targets, making themselves more vulnerable to Shrike attack.

POST-ROLLING THUNDER

Although tactical strikes on North Vietnam ended by 1 November 1968, practice missions were still occasionally mounted for a further six months, with F-105 formations accompanied by EB-66C/Es approaching to within a few miles of the border and triggering early warning and air defence radars before turning back. Air activity over the Ho Chi Minh Trail areas of Laos greatly increased post-*Rolling Thunder*, and reconnaissance over

the whole area continued. Lockheed AC-130 gunships, C-130 propaganda leaflet droppers and SAR forces all needed warning and jamming of radar-guided AAA.

Working with SAC's RC-135M *Combat Apple* jets, which had replaced its EB-47H signals intelligence aircraft, five EB-66Cs from the 42nd TEWS provided the primary tactical electronic reconnaissance for the massive *Commando Hunt* operations against supply traffic on the Ho Chi Minh Trail. They sought out hostile fire control radars, including 'Fire Cans', that were causing numerous aircraft losses over the Laotian jungle and conducted electronic reconnaissance when poor visibility and monsoon conditions prevented photo-reconnaissance. However, the Destroyers' obsolescent navigation and direction-finding equipment had difficulty in locating the exact positions of hostile radar sites to within less than a ten-mile radius. In jungle conditions, that was far too inexact to mount air strikes on the sites.

From the end of *Rolling Thunder* onwards, EB-66s made increasing use of chaff. After careful study of the forecast for wind directions, the aircraft distributed chaff at safe distances from known SA-2 sites and allowed air currents to carry it towards the target. Successive bundles were dropped over a period of up to three hours before a tactical or *Arc Light* strike in order to screen the approaching strike force.

Until the end of *Rolling Thunder* the EB-66 squadrons continued to provide very effective EW support for missions over the North Vietnamese panhandle. Their utilisation remained high, with 2044 combat sorties by 38 aircraft from October to December 1968 alone. They had proved their value to an unexpected extent during the previous year, and revealed the USAF's shortage of resources to deal with radar-guided weapons, particularly the SA-2.

Jamming orbits were continued from stations over the Gulf of Tonkin and new ones were added over Laos to blind some of North Vietnam's early warning radars. Their value was greatest against radar sites that could be jammed at fairly close quarters without subjecting the EB-66s to SA-2s and AAA. As a 1972 study paper by the Joint Chiefs of Staff pointed out, 'Stand-off jamming cannot adequately degrade terminal threats along the penetrating aircraft's flight path unless the radar is forced to look in the direction of the jamming platform'. Where possible, enemy radar operators avoided that risk.

EB-66E-DL 54-509 of the 42nd TEWS departs Korat in 1971. From mid-1967 onward, most of the original EB-66 crews who had come from USAF or Shaw were replaced by newly trained personnel with little experience of the aircraft (*Terry Panopolis*)



Pre-planned missions were introduced at the end of 1967. EB-66s had to keep to set routes and turn their jammers on and off at specific points. Jammers were pre-set to emit their maximum power at certain map coordinates in order to hit individual radars. The tracks flown by combinations of EB-66Bs and EB-66Es were arranged so that they crossed over, confusing enemy radar operators as to the nature of their target. Despite these new tactics, radar operators were able to penetrate the jamming at times and direct AAA and missiles. They were also able to pass radar detection of an approaching strike force from one 'Flat Face' acquisition radar to the next, along a chain of radar stations, so that a strike was constantly monitored. These radars were frequently moved so that they were hard to take out with air strikes.

From November 1968, EB-66Cs flew many protective missions for reconnaissance flights. They were also able to resume ELINT missions and glean much-needed data on the full range of radar threats, which had been limited towards the end of *Rolling Thunder* by the need to analyse specific radar sites during air strikes so that they could be jammed by EB-66Bs. ELINT missions from 1968 showed further developments in North Vietnam's radar technology, including new low-frequency early warning radars that could not be covered by EB-66 jammers, particularly as the latter were seldom updated.

The scarcity of EB-66s had been highlighted again in January 1968 when North Korea seized the US intelligence gathering ship USS *Pueblo* (AGER-2) and no ECM assets were available in South Korea for potential retaliatory action. Two EB-66Cs and four newly received EB-66Es had to be borrowed from Shaw, dramatically slowing the 363rd's EWO training programme as only one EB-66C was left available at the base. Trainee EWOs had to rely on the dated, two-seat RB-47H simulator supplied to Shaw by SAC. Two EB-66Cs were returned to Shaw the following month.

Other aircraft were requisitioned from the overstretched operational unit in Thailand to allow Operation *Combat Fox* to be organised at the newly reopened Itazuke AB in Japan. By 18 February four EB-66Es had been transferred there for Det 1 of the 363rd TRW, the aircraft being flown by crews from both Shaw's 4417th CCTS and from Takhli. The unit was re-designated as the 19th TEWS on 1 January 1969 and attached to the 18th TFW at Kadena AB, Okinawa, as an eight-aircraft jammer squadron without an ELINT tasking. Its responsibilities in Korea ended on 31 August 1970 with the deactivation of the 19th TEWS and the return of the EB-66Es to Shaw.

On 31 December 1968 the 19th TEWS was reassigned from Shaw's 363rd TRW to the 18th TFW at Kadena, with its aircraft receiving ZT codes, to respond to the seizure of the US Navy intelligence gathering vessel *Pueblo*. Detachments were established at Osan AB, South Korea, and Itazuke AB, Japan, until the squadron was inactivated at Kadena in October 1970. 54-(O)545, which was an ex-10th TRW jet, was then sent to the MASDC and eventually salvaged in November 1976. Among the many external additions to the EB-66E airframe were two ram-air cooling intakes – seen here on the tail cone immediately below the rudder – for the ECM installed in the Mod 2259 programme (USAF)



One Takhli EB-66C was retained beyond the immediate crisis to fly regular radar surveillance missions along the North Korean coast, although an accurate radar intelligence survey that was on a par with what was available for North Vietnam was obviously impossible unless a significant number of radars were switched on at the time of an ELINT flight.

Despite the aircraft's continued importance, the demands on the EB-66 squadrons were reduced after *Rolling Thunder*. The USAF's policy of retiring EB-66s also began to take effect with the inactivation of the 41st TEWS on 31 October 1969, cutting the Thailand-based total from 38 EB-66s to 14 EB-66Es and six EB-66Cs. The 11 surviving *Brown Cradle* EB-66Bs went into storage and spare EB-66Es were supplied to the 19th TEWS at Kadena.

PATHFINDER

From 1966 EB-66 missions had also extended beyond North Vietnam with Pathfinder-led strikes along the Ho Chi Minh Trail and in South Vietnam. The lack of an effective all-weather bomber was a serious handicap to the USAF's tactical wings, fighting a war in a country where visibility was badly degraded by the monsoon for several months of the year. Informal discussions between F-105 and *Brown Cradle* crews resulted in trials of blind bombing in which the EB-66B used its superior electronic K-5 bombing-navigation system to lead F-105s to targets that were invisible through thick cloud. It was a technique that Destroyer squadrons in USAFE had already developed in 1959 when *Brown Cradle* aircraft and RB-66Bs led F-100D formations to targets in cloudy European conditions.

Trials in Thailand yielded acceptably accurate results, and Pathfinder combat missions commenced later in 1965 with an EB-66B leading flights of fighter-bombers, including F-105s, F-4s and, occasionally, B-57s, with appreciable success. The formation was led above the cloud base by the EB-66B navigator, who transmitted a tone to the fighters. They dropped ordnance simultaneously following a countdown at the exact moment when the tone transmission ended.

On 31 January 1966 an EB-66B acted as Pathfinder for 20 F-105s from the 355th TFW in the first attack of its kind on North Vietnam. The same crew subsequently guided 12 F-105s to bomb dockside installations near Vinh. In another attack on coastal traffic, four B-57Bs were led by an RB-66B and bombed ammunition barges, causing spectacular secondary explosions.

Many more similar missions might have been conducted, but the shortage of *Brown Cradle* EB-66Bs precluded much expansion. In May 1966 most Pathfinder missions were replaced by *Combat Skyspot* radar-directed bombing using radar sites in South Vietnam and Laos to direct formations of fighter-bombers to exact map coordinates.

An EB-66B *Brown Cradle* uses its K-5 navigation-bombing system to act as pathfinder for a flight of F-105Ds in 1966. An RF-101C pilot managed to catch this perfectly synchronised drop of M118 3000-lb demolition bombs with his reconnaissance cameras (*Terry Panopolis*)



Pathfinder missions, lasting up to five hours with multiple refuellings, were extended into Laos against targets on the Ho Chi Minh Trail. Suspected truck convoys in the Mu Gia Pass were attacked, but the vulnerability of the EB-66B meant that areas where MiGs operated had to be avoided. Pathfinder flights ended on 18 November 1967 because the spread of SAM sites put the formations at risk of missile launches, unseen below heavy cloud cover.

KEEPING THEM FLYING

Heavy combat utilisation of EB-66s made considerable demands on the maintainers, who still managed to sustain high rates of availability for their ageing machines. For deep maintenance, aircraft had to be flown to Clark AB, in the Philippines, or to Douglas's Tulsa plant. The B-66 production line closed in 1959, and this, together with frequent announcements of impending retirement for the Destroyer, resulted in an acute shortage of spare parts. The uneconomical manufacture of small numbers of spares was predictably unpopular with the USAF accountants. By the end of Operation *Linebacker II* the spares lockers were just about empty.

The aircraft's marginal performance on a single engine, together with the lack of a fuel dumping system, was a source of concern on take-off. The weight of the EB-66 versions, far beyond the USAF's original B-66 specification, combined with the hot and humid conditions in Southeast Asia, made take-offs with both engines a lengthy process. Aircraft usually took off with a partial fuel load, meeting a tanker soon after reaching cruise altitude. As Col Ian Rothwell observed, loss of an engine during the take-off run determined that 'a crash was inevitable'.

Two 'Elmo' EB-66Cs took off on a 17 November 1967 mission from Takhli, with 54-473 climbing away behind 'Elmo 1'. Maj Max Nicholls announced the failure of his No 2 engine as he continued a climbing turn, and he requested an immediate return to base. He had at least managed to retract the landing gear, but he also needed to sustain 210 mph to stand a chance of remaining airborne. As he approached the five-mile point on his final approach, the aircraft began to lose altitude, despite a high-power setting on the remaining engine. The Destroyer belly-landed 1200 ft short of the runway and burst into flames.

Although Maj Nicholls attempted to release his overhead escape hatch, as did an EWO, the only crew to escape were two 'Ravens' from the aft crew compartment, assisted by SSgt Joseph Vultaggio from a rescue helicopter. Fire crews attempted to break open the cockpit hatches, but Nicholls finally decided to use his ejection seat. He and the seat fell back into the blazing wreck. The navigator, Maj Bill McDonald, was on his first combat mission.

Similar incidents had occurred since October 1958, when RB-66B 53-411 crashed after a single-engine take-off, and they continued through to 1969, when *Brown Cradle* EB-66B 53-498 'Hydra 9', bound for the Mu Gia Pass to provide jamming for an *Arc Light* attack, lost its left engine at the 5000 ft point of its take-off run from Takhli on 8 April 1969. With white smoke gushing from the engine, the aircraft had to continue its take-off as there was no available barrier arrestment gear, and it lifted off briefly before it banked to the left, hit the ground with 27,000 lbs of

fuel aboard and exploded, killing all three crew. Lt Col Edwin Anderson, the 42nd TEWS's squadron navigator, and EWO Capt Joseph Orlowski ejected but landed back in the flames.

The half-minute between reaching S-1 (the point at which an aborted take-off could be executed, with the aircraft over running the end of the runway) and reaching single-engine flying speed was known as 'coffin corner', and it left a pilot with little hope of survival.

Following this accident, EB-66 flights were severely restricted during May 1969. All engines with over 1200 hours on them were inspected at that point and had their vulnerable 13th compressor stages replaced. More than a third of the engines were affected, requiring a two-month maintenance effort that grounded numerous aircraft and eventually resulted in the cannibalisation of engines from EB-66Cs in 1971-72. In November 1971 two Korat aircraft were also withdrawn due to wing spar cracks. Take-off fuel loads were subsequently restricted to only 15,000 lbs.

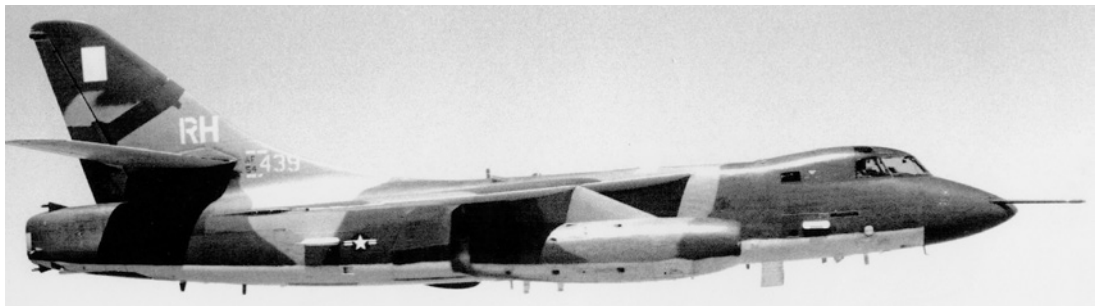
EB-66E 54-439 'Wring 69' experienced an engine explosion as it prepared to take off from Takhli on 21 April 1970, but the crew were all able to escape. A similar explosion devastated 42nd TEWS EB-66E 54-427 'Mascot 22' as it ran up its engines preparatory to take-off on 17 November 1971. On this occasion the disintegrating J71 sent turbine blades scything into the fuselage fuel tank. Again, all three crew managed to exit the aircraft.

Another pilot and two 'Ravens', together with an irreplaceable EB-66C (54-062), from the 41st TEWS were lost on 6 December 1967 when the jet was apparently caught in wind shear as it approached Takhli's runway after a Ho Chi Minh Trail mission. Lt Col Jack Youngs struggled to maintain control, and when the aircraft started rolling at low speed he gave the ejection order. All six men punched out seconds before the aircraft crashed 1800 ft to the right of the runway overrun, and only three survived ejection at such low altitude.

Korat's runway, famous for the dip in its centre portion, claimed EB-66E 54-540 on 2 February 1972 when its lower rear fuselage scraped the ground on rotation along the 'uphill' side of the runway. The aircraft duly slid to a halt, never to fly again.

The loss of even one RB-66C from the 36 originally built at that time made the EB-66E jammers' job harder and reduced the amount of new ELINT data. Any suggestion of replacing the J71 engines with more reliable and economical powerplants such as the many surplus J57s or TF-41 turboprops in USAF storage, or increasing the numbers of aircraft in the 42nd TEWS to maintain its availability, were rejected by the USAF. This was in accordance

42nd TEWS/355th TFW EB-66E 54-439 joined the unit in 1968 after 11 years of USAF service. En route to Tulsa for deep maintenance as 'Wring 69' on 21 April 1970, it was preparing to take off from the staging airfield at Hickam AFB, Hawaii, when the No 2 engine exploded and started a fire. Majors William Fletcher (pilot) and Charles Quinn (navigator), along with crew chief Sgt George Stevens, escaped via their hatches and the crew entrance door without injury while fire trucks suppressed the blaze (USAF)





EB-66E-DL 54-440 in the 42nd TEWS/355th TFW dispersal area at Takhli on Christmas Day, 1968. As the principal ECM aircraft in Southeast Asia for almost four years, the EB-66s' missions included EW protection for *Bumpy Action* reconnaissance drones and C-130 Hercules dispensing propaganda leaflets over the Ho Chi Minh Trail during *Gray Creeper/Frantic Goat* missions. EB-66s protected most of the 1976 drones launched from 1967, restricting losses to VPAF fighters, AAA and SAMs to 364 – about a third of these losses were actually caused by drone malfunctions (*Terry Panopolis*)

with the Pentagon's determination to retire the EB-66 fleet early in 1973, although there was still no replacement in sight for the aircraft. Retirement demands, based entirely on the airframe hours in their logbooks, began to remove even the few, much-needed EB-66Cs from 1972.

However, 1967 did see the first major update in the EB-66C's EW suite with the introduction of steerable AN/ALA-32 antennas, derived from a similar installation in the US Navy's EA-3Bs, except that the Skywarrior had 20 rather than the EB-66C's five antennas. Used in connection with the aircraft's direction-finding equipment, they gave EWOs the capability to direct their jamming emissions strongly against a hostile source. They were first used on a March 1969 *Bumpy Action* drone support mission, although many of those operations were passed on to the EA-3B squadrons.

Some of the ongoing maintenance issues dated back to the re-design of the aircraft from its A-3 Skywarrior origins. Sealer in the integral wing fuel tanks of most EB-66s tended to crack under the stresses of flight, causing fuel leaks and prolonged grounding that reduced the average of available aircraft by two-thirds to only six in October 1972. The redesign of the A-3's forward fuselage when Douglas had originally created the B-66 induced stresses that caused the Destroyer's window transparencies to crack and produced excessive noise and vibration within the cockpit.

Neil Byrd was an F-105 Thunderchief maintainer at Takhli in 1970;

'The EB-66s were taken care of by a different group who also took care of the KC-135s. The general consensus of my cohorts in the 355th Avionics Maintenance Squadron was that the ECM guys were a rather strange lot. Their shop could have been in the same maintenance building, but it was well hidden.

'Another guy and I from the "Thud" unit got sent out once to a parked '66, but we had no idea what we were facing. Being totally in the dark with no relevant training and no manuals, I knew enough to leave everything well alone and walk away. I remember how insufferably hot it was in the cockpit though. Some sympathetic crew chief saw us and got an air conditioning ground unit running and pushed a duct up towards the cockpit. He must have known we were rookies to even try working in there without air conditioning. That experience and the piercing whistle of the engines at taxi speed are my clearest memories of the EB-66.'

FIREBEE FLIGHTS

Pairs of EB-66C/Es protected AQM-34 Firebee reconnaissance drones over North Vietnam, jamming any radars that attempted to direct interceptions against them. They often flew parallel to the drone's flightpath at a safe distance offshore. Many drones were programmed to fly near Haiphong and Hanoi at around 500 ft, requiring up to four EB-66s to project jamming directly at 'Fan Songs' or other acquisition radars. On one occasion in July 1969, a drone launched from above Laos, and supported by EB-66C/Es, succeeded in flying across Hanoi at low altitude unchallenged. The majority, normally launched offshore, met opposition. An EB-66C with steerable antennas was the most effective platform for this kind of targeted jamming, and it always gave 'Ravens' opportunities to study the many radars that would be trying to catch a Firebee.

Improved secure communications equipment installed in EB-66s and the DC-130A Hercules drone launchers facilitated tracking of the drones. Some drones with deception jammers known as *Rivet Bounder* and *Hat Rack* flew at high altitude over lower-threat areas, but the majority, at low altitude over Hanoi and Haiphong, needed greater protection, particularly towards the end of their flights when they climbed across the coast to their recovery altitude. VPAF pilots sometimes intercepted them at that point, and they became 'training targets' for many MiG-21 pilots.

MiG pilots were allowed periods of several weeks in which they took over the interception task from the SA-2 batteries. From 3 March 1968 to 27 July 1970, VPAF pilots claimed 34 drones out of the 50 monthly launches. Many Firebees contained their own deception jammers, or devices to initiate automatic anti-SAM or anti-MiG manoeuvres when triggered by a radar emission from a 'Fan Song' or a VPAF fighter. ECM assistance for drones was provided by EA-6As from May 1969, and these aircraft, with steerable antennas, coped with modifications to 'Fan Songs' that enabled them to use the higher frequency I-Band bandwidth. EB-66Es were also subsequently given that capability. Jamming by EA-6As ended on 27 June 1970, leaving drone protection to the EB-66s.

The MiG threat continued, but the tables were turned on 10 July 1968 when a US Navy MiGCAP was alerted to a planned interception of an A-7 Corsair II attack flight by three MiG-21s north of Vinh. An EB-66E, a US Navy EKA-3B and a US Marine Corps EA-6A jammed the MiGs' GCI communications and radar. 'Raider', an interception controller on board USS *Horne* (CG-30), monitored the launch and approach of the MiGs. Lt Roy 'Outlaw' Cash was flying one of VF-33's brand-new F-4Js in the MiGCAP. As he told the author;

"'Raider' kept us apprised of the increasing activity, and MiG communications. Our ECM and spy planes had picked up good info on the MiGs, apparently. The MiGs finally launched and started south. 'Raider' vectored us west [so that the F-4s could turn and come "out of the sun" at the bandits]. We were told that the MiGs' communications were being jammed by our EKA-3B ECM bird, sitting just off the coast. That meant they would probably not know we were coming.'

Cash closed in behind the leading MiG and fired an AIM-9G Sidewinder;

'I watched it guide and impact the tail area of the MiG, blowing the empennage clean off. The pilot [Pham Phu Thai of the 921st FR]

obviously knew he was had because almost simultaneously with the impact I saw his 'chute.'

The later *Red Baron* report on the action stated that 'ECM had a vital contributing role in the success of the mission'.

BACKING 'BUFFS'

B-52 *Arc Light* missions in Laos and South Vietnam also increased, and SAC required EB-66 and *Iron Hand/Wild Weasel* assets to be available for its bomber missions, with an emphasis on defeating the enemy's early warning radars. Up to three EB-66s were needed per mission, depending on the type and location of the target. If the latter was within 20 miles of a known SAM site (just beyond the maximum range of an SA-2), the EB-66s had to fly orbits so that their radiation was perpendicular to the B-52s' approach and exit routes. When they turned at the end of each 'race-track' leg, their EWOs dropped chaff to compensate for the weakening of the jamming emissions at those points.

EB-66s sometimes had to 'troll' for the missiles at altitudes 8000 ft below the B-52s so that they could emit targeted jamming. This gave minimal time for avoiding an SA-2 in conditions where the missile could reach 25,000 ft from launch during a count of ten by the EB-66 crew. The resulting 'SAM break' dive to avoid an SA-2 had to force the missile to turn at more than the 2g limits of its guidance gyros, breaking its lock. The ageing and overburdened EB-66Es had difficulty in maintaining orbits at around 25,000 ft, while B-52s could bomb from 35,000 ft, projecting their own jamming over a wider area.

The areas of North Vietnam where supply convoys for NVA troops in South Vietnam entered the Nape, Ban Karai and Mu Gia mountain passes were regularly targeted by B-52s. North Vietnamese defences in those areas were, therefore, greatly strengthened. Mobile 'Fire Can' AAA radars and SA-2s with their supporting radars were moved to the edges of North Vietnam, close to target areas, and Vinh became a centre for SAM activity. By May 1968, seven SA-2 sites had been established south of the 19th parallel. Shooting down B-52s became a national priority, and with 206 Stratofortresses in the area by May 1972, the odds were shifting in Hanoi's favour.

Protecting the B-52s became the primary aim of the EB-66 force, and it began *Tiny Tim* escort missions in April 1967. Two EB-66s preceded the *Arc Light* bomber cells to assess the SAM threat. If the situation appeared to be too hazardous, the B-52s would be diverted to a safer secondary area. Sometimes, these missions led to effective anti-SAM strikes. An EB-66 escorting a 27 April 1967 *Arc Light* identified a SAM site in the east of the DMZ and warned the B-52s to divert. Two days later, the site was destroyed by strike aircraft.

Tiny Tim participants maintained the proud record of preventing any B-52 losses to SAMs or MiGs while under the protection of EB-66s, supported by the bombers' own jamming. Although this new phase of the war did not involve daily penetrations of the massive, multi-layered defence network around Hanoi, the demands on the small EB-66 community were considerable. In early 1967 up to 14 Destroyers could be active simultaneously in support of several strikes.

For *Arc Lights* on targets close to North Vietnam, a pair of EB-66s would orbit within about ten miles of the intended target, jamming any threat radars and dispensing chaff in orbits 40 miles long and around four miles in width. Their ALE-1 chaff dispensers could be loaded with one type of chaff to deal with low-frequency radars or a high-frequency version to blot out fighters' interception radars.

'FAN SONG' TWEAKS

During *Rolling Thunder* SAM batteries had evolved manual 'three point' guidance, where each of the three 'Fan Song' operators controlled one of the three functions (range, elevation or azimuth) for the missile using a control wheel and a radar scope. Triangulation techniques using several separate radars such as 'Spoon Rest' could also be employed to avoid using the 'Fan Song' to transmit signals for all aspects of the launch process. One site could track a missile and another would launch it, confusing the EB-66's receivers.

From 1968 the 'Fan Song F' version added optical tracking for daylight use in the final stages of guidance, by which time it would be too late to avoid the missile. In 'track on jam' mode, operators could even lock the missile onto the jamming from a B-52 or EB-66 in the hope that the SA-2 would get sufficiently close to the target prior to reaching its detonation point in order to cause lethal damage.

With Soviet assistance, 'Fan Songs' were equipped with 'dummy load' heat-sink plugs so that the unit could be kept on standby on full power and turned on at 30 seconds' notice to make a quick target location and lock-on before countermeasures could be applied. Meanwhile, target data would be supplied by the battalion's acquisition radar or a nearby early warning radar. As a target approached, the 'Fan Song' would be switched from standby to active, and immediately start to transmit at the high pulse frequency that EB-66Cs would detect just before a launch, rather than the dual emission, initially indicating a target acquisition or

Personnel from the 42nd TEWS' maintenance departments 'stress-test' an EB-66E for the 1970 'class photograph'. Flight crews are ranged on the tarmac in front of the jet. The squadron commanders in 1970 were Lt Cols Henry Boardman and Morris Shriver and Maj Gerald Loughlin (Terry Panopalis)



launch warning and followed by the higher-frequency signal showing an actual launch.

All these methods presented more problems for EW crews than the missile's basic automatic tracking mode. In December 1969 SAMs were fired from inside North Vietnam at a cell of B-52s and their two EB-66 escorts over Laos. Of the three missiles fired, one came within 50 ft of a B-52 and the other two passed within a mile of the EB-66s. There had been no indication of a launch on any of the EB-66s' RWR equipment, although B-52 EWOs did pick up a brief 'Fan Song' signal just before the launch, which had obviously been preceded by passive tracking and triangulation.

SAM operators knew that their best chance of a successful lock-on was to 'burn through' even the most powerful Phase V B-52 internal jamming when the bombers were directly overhead or in a banking turn. This was made easier by using several 'Fan Songs' against a single target. Near the DMZ or in Laos, it was much more difficult to position SAM equipment within that minimum range of a potential target. By 1969 the situation had changed markedly, and EB-66s were being forced further from the SAM-defended strike routes that they normally defended. They were also denied extensive fighter escort.

The following year, the 42nd TEWS moved to Korat RTAFB, joining the 388th TFW with eight EB-66Es and five EB-66Cs on 30 September 1970. Six aircraft returned to Shaw, but as hostilities increased again after advances by the Army of the Republic of Vietnam (ARVN) into Laos and Cambodia in 1970, the 42nd TEWS received nine additional aircraft from the 363rd TRW in May 1971, taking the unit's total to 22 aircraft through the *Coronet West* deployment. At the same time, the retirement date for EB-66s was extended by a year.

Destroyers duly answered increasing demands for *Commando Hunt* ECM missions over the Ho Chi Minh Trail, where EB-66s and other EW aircraft were urgently trying to reduce the AAA threats by locating 'Fire Can' units. From October 1970 the intensive *Commando Hunt V* campaign required 24-hour ELINT coverage, and most of that had to be accomplished by five EB-66Cs, supplemented by EA-3Bs, EA-6As and Kadena-based EC-135Ms.

From 26 December 1971, Hanoi's increasing air defences over crucial sections of passes leading to the Ho Chi Minh Trail prompted almost 1000 attack sorties in five days. Known as Operation *Proud Deep Alpha*, it required 182 EB-66 missions, which came under heavy SAM attack throughout. For the first time in five years the Destroyers were allowed to fly within lethal range of SA-2 batteries, supported by *Iron Hand* suppression flights. Fuel depots, SAM sites and truck parks were primary targets.

More than 100 radar suppression missions were also mounted by *Wild Weasel* and EB-66 units and US Navy *Iron Hand* aircraft to reduce the large numbers of SAMs that had been moved into the area since the end of *Rolling Thunder*. The attackers were hampered by bad weather, but so was optically aimed AAA. Despite extremely heavy AAA defences, losses were restricted to three strike aircraft – two of them fell to the 45 SAMs that were launched. Effective EB-66 radar suppression was considered vital to this success against 'Fan Song' and 'Fire Can' radars. EB-66Es were able to fly jamming orbits near SA-2 sites, with one jet, flown by Lt Col Frank R Wink, having to make

strenuous SAM avoidance manoeuvres to avoid a salvo of three missiles on 29 December.

Another trio of EB-66s accompanied a strike force of 34 F-4s hitting targets near the Mu Gia Pass that same day. Lt Col Jack Tullett's EB-66E jammed all the enemy's acquisition radars, while an EB-66C in the same flight 'catalogued' all the 'Fan Songs' in the area. There were no F-4 losses, and *Proud Deep* was a convincing demonstration of the EB-66s' continuing value after six years at war.

B-52 support continued into 1972. According to the USAF's Special Communications Center, the EB-66s were important in adding 'a confusion factor to the enemy's air defence system. The effectiveness of EB-66 jamming of "Fan Song" is dependent upon optimum positioning relative to the threat radar and target aircraft'. EB-66 crews would have liked more flexibility in planning routes that achieved that 'optimum positioning', and they felt that the rigid orbits for *Arc Light* support imposed by the Seventh Air Force gave inadequate protection to the B-52s, and also supplied enemy radars with useful tracking information.

North Vietnamese SAM batteries' tracking of B-52 cells improved, and in attacks on Than Hoa in April 1972 up to 12 SA-2s were fired at the bombers using 'track on jam' mode, damaging one on the 23rd. The other missiles were diverted by chaff, jamming or *Wild Weasel* action. An attack on Haiphong's fuel storage depots on 15 April required stand-off jamming by three EB-66Es, three EKA-3Bs and an EA-6A, in addition to the B-52s' own jammers, to cover all the threats. *Arc Light* missions over North Vietnam continued until November, with 2300 sorties aimed at the enemy's supply lines as preparations to invade South Vietnam continued. When a bombing pause in December failed to bring Hanoi to the negotiating table, President Richard Nixon ordered the commencement of Operation *Linebacker II* on 18 December.

Tactical fighter-bombers had two new ECM pods available for their attacks in the new campaign. The AN/ALQ-101 and -119 emitted modulated noise jamming, but they could also project a deceptive radar return, fooling a hostile radar into 'seeing' the target in a different place



The 42nd TEWS' move to the 388th TFW at Korat in September 1970 was marked by a JW tail code change, and it remained there until March 1974. RB-66B-DL 54-520 had previously served with the 10th TRW from 1958, and following conversion to EB-66E configuration in 1966 the jet operated with the 363rd TRW until it was transferred to Korat in 1971 in the face of increasing North Vietnamese threats to the Saigon regime (USAF)





EB-66E-DL 54-438 with the sharkmouth nose art that Capt Bob Welch (42nd TEWS Maintenance Officer) was given permission to display on 'his' aircraft by Gen John Ryan, USAF Chief of Staff, on a visit to Korat. No other RB-66s were allowed this artwork, which was standard for the 388th TFW's F-4Es. The lower section of the engine nacelle could be removed for maintenance (USAF)

In 1959 all USAFE RB-66B/Cs were equipped with in-flight refuelling probes. Access to SAC's KC-135A tanker fleet, fitted with an adaptor hose and 'basket', made long deployments to the Far East by Destroyers like this RB-66C (seen over Southeast Asia) much easier. However, during Operation *Rolling Thunder*, KC-135As were predominantly equipped with unadapted Flying Booms for B-52s and most tactical aircraft. B-66 pilots occasionally had to curtail longer missions due to the lack of adapted tankers, or fly out to sea to find a US Navy tanker aircraft with probe-and-drogue equipment (Terry Panopalis)

than its true location. In 'special' mode, the pods could also jam the downlink beacon that transmitted the SA-2's position to the 'Fan Song' operators, who had to increasingly resort to optical tracking in the face of such comprehensive jamming. This in turn limited them to daylight operations – most *Arc Light* missions were nocturnal. The new pods also reduced the chances of passive 'track on jam', which had

been possible with the AN/ALQ-71. With the latter pod, when jamming the downlink it could also briefly reveal the strike aircraft's location.

During May 1972 the use of chaff 'curtains', masking a B-52 or tactical strike force on either side of a 'corridor' of chaff from canisters dropped by F-4s as they approached their target, posed major difficulties for enemy radar operators. On 10 May an F-4 attack formation had 160 SA-2s fired at it, but ECM and chaff corridors prevented losses. During several subsequent *Linebacker II* attacks, including a B-52 mission against fuel storage depots in Haiphong on 15 May, chaff corridors were disrupted by wind. However, the B-52s' own ECM, supported by three EB-66Es, three US Navy EKA-3Bs and a US Marine Corps EA-6A, prevented any losses amongst the bombers.

Wind could also be used to the EB-66s' advantage for chaff distribution. Aircraft would set up orbits in positions that allowed the wind to carry their chaff towards the target area and interfere with hostile radar installations. Chaff was carried in bundles rather than chaff bombs and dispensed at regular intervals to preserve a screen effect ahead of a strike. Dropping 24 bundles per minute, an EB-66 could continue to dispense the radar-reflective metallic strips for at least 15 minutes – the screening process could be extended for longer ahead of a strike, depending on wind conditions. Sometimes parachute-retarded chaff was used to prolong its airborne time.

During the *Linebacker* campaign the 42nd TEWS continued its valuable long-distance jamming of early warning and interception radar sets. AAA and SAM batteries were then forced to rely on their own target acquisition radars, opening them to attacks by *Wild Weasels*. EB-66Es also blocked 'Fan Songs' if they were located at forward positions outside the main areas of air defence. Otherwise their jamming signals were too attenuated by distance to have the required effect unless a radar was 'looking' directly at the EB-66. Although their achievement was seldom credited, Destroyer crews knew that no B-52s were lost to heavy AAA or SA-2s when they were providing ECM escort, and there were no attempts at interception by MiG-21s.

THE SPONSOR'S VIEW

In a Soviet assessment of the NVA's defences up to 1967, Gen Maj M Naumenko acknowledged that US techniques such as 'noise jamming of radar on various frequency bands were well known to us before', but he judged that 'the Americans have greatly intensified the jamming of missile guidance radars and radar means of detection', including

fielding 'special EB-66 aircraft for active jamming, which patrol the Vietnam–Laos border and the Tonkin Gulf'. He also noted that 'the Shrike guided missile may represent a serious danger to the guidance radars for SAMs and other air defence radio-technical means, especially in the event that the Americans succeed in equipping it with a special memory device [here, he is anticipating the AGM-78 Standard ARM, introduced in 1968]'.

Naumenko's response to the continued improvements in American techniques for neutralising the NVA defences was Soviet determination to 'bolster the defensive capability of the country'. He also judged that the Soviet Union had 'begun to solve the extremely acute problem of training Vietnamese personnel to use modern weapons competently. The system of battle formations for radio-technical and AAA units became more orderly'. A predominant Vietnamese perception of air defence being based on the principle of 'the weak against the strong' in which defences concentrated on 'guerrilla tactics – the destruction of enemy aircraft in places where they did not expect it' had been replaced by a coordinated effort that concentrated the defences around high-value targets such as cities and airfields.

The command of these assets was then centralised under military control, rather than being 'distributed uniformly around the entire territory of the country' in the hands of 'various semi-guerrilla detachments and even the civilian population'. Naumenko did observe that the 37 mm AAA guns had been the most effective, while heavier-calibre radar-directed guns had suffered from inadequate use of their associated radar warning and fire control radars.

Reflecting the Sino-Soviet rivalries of that time, he saw a major problem in 'the influence of Chinese advisors on the medium-calibre AAA units who do not know how to operate, repair or adjust them properly'. Chinese advisors were also blamed for the habit of firing a single missile to 'frighten away groups of American aircraft flying under cover of jamming' at low altitude, rather than engaging targets properly and firing the standard three-missile salvo.

Some of these perceived weaknesses were beneficial to the EB-66 community in 1965-66, but by 1967 the 'bolstered' and better-organised NVA defences made their tasks increasingly difficult. Before 1967, when SAM units frequently operated as independent battalions 'without any intercommunication or fire cooperation with each other', they tended to 'mislead the American command about the strength of the SAM troops' according to Naumenko. As a result of the 'absence of continuous SAM zones on the approaches to the main installations in North Vietnam', it was judged that 'American aviation often got through to these installations through gaps between the fire zones of the battalions'.

Soviet-style missile rings placed around Hanoi and Haiphong often presented the EB-66 force with a jamming requirement that exceeded the capacity of two or three aircraft.

By December 1972 SAC planners were aware of 45 SA-2 sites, with 26 located north of the 20th parallel. Twelve were arranged around Hanoi and nine in the Haiphong area. They would be reinforced during *Linebacker* by battalions from further south. SAC's revised statistics for North Vietnam's AAA assets listed 884 weapons of 37 mm or above.



CHAPTER SIX

THE FINAL ROUND

Post-war, most of the surviving EB-66Es were retired and scrapped at Clark AB, in the Philippines. Amongst their number was 54-431, seen here on 25 January 1974. It had served with the 39th TEWS/36th TFW in 1972 (when the jet had acquired its 'barber pole stripes' on the refuelling probe – a common addition amongst Destroyers during this period) before its final transfer to the 42nd TEWS/388th TFW at Korat. Most of its ECM equipment and antennas had been removed by the time this photograph was taken (USAF)

Reports of an impending communist invasion of South Vietnam were confirmed when Maj Dave Brookbank, flying a fragile O-1 Forward Air Control (FAC) aircraft near the DMZ on 30 March 1972, reported considerable NVA troop activity. American troop withdrawals in the previous three years had left only token ground and air forces in the region to support the Vietnamization policy in which South Vietnam would conduct its own defence.

Most of the remaining USAF presence was in Thailand, including the HH-53C-equipped 3rd ARRS and the 23rd Tactical Air Support Squadron (TASS) with 15 OV-10 *Pave Nail* aircraft. There were two aircraft carriers in the Gulf of Tonkin, and destroyers could provide heavy gunfire against shore targets. Major USAF reinforcements were en route to Thailand in Operation *Constant Guard*, while US Marine Corps fighter-bomber squadrons were being deployed to Da Nang and SAC was sending B-52s to Guam.

Gen Vo Nguyen Giap, commander in chief of the NVA, had waited years to make a determined assault on South Vietnam using armour, massive troop numbers and heavy AAA defences in a three-pronged attack from Laos, Cambodia and North Vietnam. After the advance was detected, air strikes and gunships were called in, but Giap had planned his attack at a time of heavy cloud layers extending up to 15,000 ft. Many air strikes had to use pathfinder RF-4Cs or *Skyspot* techniques pioneered by RB-66s

to try and prevent ARVN units from being overrun. Radar-guided B-52 attacks began on 1 April, and US air losses resumed the following day when 20th TASS O-2A FAC 'Mike 81' was hit by AAA. It was during a B-52 strike with ECM support south of the DMZ that the most famous EB-66 loss, and subsequent rescue attempts, took place that same day.

One *Arc Light* cell (call-sign 'Copper') had been directed against a road near Camp Carroll, a major ARVN stronghold that had been surrendered. It was on a main NVA approach route defended by numerous SAM sites, including the first in South Vietnam, as well as AAA. The North Vietnamese were also fielding a new and unexpected threat – short-ranged Soviet SA-7 'Strela' (Igla) shoulder-launched heat-seeking missiles, immune to jamming. SA-2s were still the main hazard for high-flying B-52s, however, so two EB-66s (with the call-sign 'Bat') from the 42nd TEWS orbited nearby.

Following their usual pattern, an EB-66E ('Bat 22') took up position to jam 'Fan Songs' and 'Fire Cans', while an EB-66C ('Bat 21' 54-466, one of the training aircraft borrowed from Shaw) orbited to locate the SAM and AAA radar positions. An F-4 MiGCAP for the EB-66s and two 'Coy' F-105G *Wild Weasels* were included.

Below them, some of the most experienced SAM battalions had been moved southwards to intercept the air cover which Giap knew was America's only way to assist the South Vietnamese in resisting the invasion. Among them was veteran SA-2 operator Nguyen Xuan Dai, a SAM range tracking controller with the 236th Missile Regiment. This unit had scored the first SAM kill in July 1965 when it shot down a 'Leopard' flight F-4C.

Also in the area was Pham Truong Huy of the 62nd Missile Battalion, who had experienced the dangers of 'Fan Song' operation when one of his fellow missile command operators had been killed by a shrapnel hit in the head moments before they set up a B-52 interception. He had not had the chance to put on his steel helmet. Huy's unit had recently moved south to Quang Tri, and it was there that it claimed a B-52 and the shooting down of 'Bat 21'.

The EB-66 crews knew nothing of the invasion that was taking place beneath them. There were no SAM sites marked on their local maps, as the missiles had only recently been moved in and South Vietnamese FACs had not kept an adequate aerial watch on the NVA forces' progress. The 42nd TEWS crews who flew in that area were well aware that SAMs had been moved in, but no one had linked them to an invasion.

The three B-52s, flying east along the DMZ towards their target, were tracked by NVA radars, and the EB-66s' task was to 'troll' for SAMs and then place themselves between the 'Fan Songs' and the bombers. Two 'Fan Songs' near Khe Sanh engaged them and fired four SA-2s while the B-52 EWOs focused their jammers. Maj Ed Anderson, an EWO in 'Bat 22', detected the SA-2's BGO-6 guidance tones and told his pilot to make the standard evasive diving turn while QRC-530 chaff was dispensed. The missiles were diverted by the various ECM emissions and burst some distance away from the EB-66E and the B-52s.

The crews' lack of information on the ground situation became even clearer moments later when more SAM sites were found to be tracking them and six more SA-2s were launched without any indications appearing



EB-66C-DT 54-466 of the 42nd TEWS sits in the squadron's dispersal area at Korat in early 1972. This aircraft, which had been built as an RB-66C and served with the 10th and 25th TRWs in USAF until 1966, was shot down over South Vietnam by a SAM on 2 April 1972 as 'Bat 21' (Terry Panopolis)

on the EB-66's AN/APR-25/26 screens. Again, the B-52s initiated jamming, but then they released their bombs and turned away. The SA-2s exploded near the flight without causing damage, as did some shells from the NVA's heaviest AAA guns. 'Coy' flight directed its Shrikes at the 100 mm guns' radar. 'Bat 22' made another diving turn to avoid the SAM salvo and 'Bat 21' picked up a third set of 'Fan Song' launch signals without the usual pre-launch emissions because the SA-2s were fired with guidance from 'Spoon Rest' or 'Flat Face' acquisition radars, rather than 'Fan Song', from a position just above the DMZ.

'Bat 21's' crew initiated jamming and tracked three SA-2s approaching them, but assumed they were coming from a southerly direction, not the north. In the few seconds of the missiles' flight to the aircraft's 24,000 ft altitude, the EB-66C began an evasive manoeuvre to the right, rapidly converting it to a turn in the opposite direction when the missiles were sighted.

Five seconds later, an SA-2 struck the belly of the aircraft, killing all four 'Ravens'. The pilot, Maj Wayne Bolte, signalled the navigator, World War 2 veteran Lt Col Iceal 'Gene' Hambleton, to eject. He was the only crewman to escape. As his seat rocketed him to safety, the EB-66C was shaken by another massive explosion, possibly from a second SA-2 hit. The explosion was seen from a nearby HC-130 command and control aircraft and also confirmed by the crew of a patrolling 366th TFW F-4.

O-2 Super Skymaster 'Bilk 34' flown by 1Lt Bill Jankowski and Capt Lyle Wilson, who were attempting to find targets among the NVA advances, had spotted the SAMs climbing towards 'Bat 21' and witnessed the subsequent explosion. As the blazing wreckage fell to earth, Jankowski heard an emergency beeper and asked its owner (presumed to be on the ground) to switch to 'voice' on his URC-64 survival radio. He could then talk to Hambleton, who was actually descending beneath his parachute several thousand feet above the O-2.

While the HC-130 (call-sign 'King 22') began to organise a rescue attempt and 'Bat 22' departed for inflight refuelling so that it could

participate in the SAR, Hambleton ('Bat 21 Bravo', in view of his role as second crew member in importance) landed in a rice paddy close to roads that were packed with enemy troops and armour heading south. 'Bat 22' refuelled repeatedly until it was finally called back into position to provide ECM cover for the rescue. Jankowski flew below the cloud to plot Hambleton's position, taking considerable ground fire in the process. While the rescue force was assembled in Thailand, darkness began to fall and Hambleton hid among trees. Jankowski stayed in place as on-scene commander for the recovery of the only known survivor from the EB-66C.

Two A-1 Skyraider 'Sandy' aircraft escorting a pair of HH-53 Super Jolly helicopters headed for the potential rescue site, unaware of the massive enemy presence. Jankowski led them to Hambleton's position, where the extent of the ground fire and enemy troop movements quickly became obvious. The first rescue attempt was made by two US Army 'Blueghost' AH-1G Cobras and a pair of UH-1H Hueys from the 8th Cavalry Regiment. Their crews were also unaware of the severe opposition, and believed that there might be six EB-66C survivors to pick up.

As the first Cobra approached Hambleton's location, firing rockets and 40 mm grenades at opposing ground fire, it and UH-1H 'Blueghost 39' were shredded by gunfire from every side. The UH-1H was hit in its engine and crash-landed behind enemy lines. Capt Mike Rosebeary steered his badly damaged Cobra away from the punitive ground fire and warned the other helicopters off, before force-landing on a beach. He and his crewman were duly recovered from here by an HH-53.

Meanwhile, Hambleton used his radio to direct the fire of the two Sandy A-1s at ground targets around him. As the weather closed in, the damaged A-1s returned to Da Nang and the HH-53s were told to hold off due to the constant ground fire. The gravity of the situation was still not realised by the Joint SAR Center (JSARC) at Tan Son Nhut AB, and in accordance with their standard practice they imposed a 'no-fire' zone with a 34-mile diameter around Hambleton's position to give the rescue force freedom of action without revealing the survivor's exact location. Later, critics saw this decision as an impediment for air attacks and artillery fire to hold back enemy forces, and therefore a cause of casualties to ARVN troops. US policy was always to bring home survivors, however difficult that task might be.

In Hambleton's case, rescue was particularly vital as he had been one of the USAF's principal experts on ballistic missiles, with top secret clearance and considerable knowledge of targeting details for America's intercontinental ballistic missiles. Unknown to his rescuers, capture and probable handing over to the Soviet Union would have damaged US security. In light of this, questions still remain about Hambleton's assignment to an EB-66 unit and how he was allowed to fly 63 hazardous combat missions.

JSARC also called in 8th TFW F-4s from Ubon RTAFB to undertake a MiGCAP in case VPAF fighters attempted to intervene or attack the command and control HC-130. Tactical aircraft flew up to 90 bombing attacks daily, many through very thick cloud using *Skyspot* or LORAN. That onslaught was to continue for ten days in an attempt to keep the NVA away from 'Bat 21 Bravo'.

A new on-scene command aircraft, OV-10A Bronco 'Nail 59' with a laser designator and advanced LORAN navigation equipment, arrived later on 3 April. It established an exact location for Hambleton, who was supplying regular reports on the heavy road traffic, including many tanks, that passed within 25 ft of him. The 'Nail' pilot, Capt Gary Ferentchak, refuelled and rearmed at Da Nang, and upon returning to the battle he was alarmed to see five SAMs launched from the DMZ at the HC-130 ('King 27') that had moved within their range. Luckily, EB-66E 'Bat 22' could report the launches and allow the HC-130 pilot, Maj Dennis Constant, to make a violent diving turn. The SA-2s exploded above his aircraft, damaging the No 4 engine and the pneumatic systems. 'King 27' departed for Da Nang, while another missile salvo was launched at 'Nail 59'. Ferentchak was also able to evade the missiles.

His watch then passed to a succession of 'Pave Nails,' none of whom received any briefing on the 'big picture' regarding the invasion or the battle raging close to Hambleton.

Two more 40th ARRS HH-53s with night vision equipment were transferred from Nakhon Phanom to Da Nang, ready for a rescue attempt later on 3 April. This effort required six 'Sandy' A-1s and two HH-53s from the 37th ARRS at Da Nang. After checking in with 'Nail 38', a SAR package of two 'Sandy' A-1s and an HH-53 was led towards Hambleton's exact position by the OV-10A. As soon as they broke through cloud cover, they attracted a storm of AAA and small arms fire that caused severe damage to 'Jolly Green 65' (commanded by Lt Cdr Jay Crowe of the US Coast Guard). With destroyed instruments and navigation systems and failing controls, Crowe manhandled the HH-53 to the nearest airfield at Hue/Phu Bai, which was under heavy enemy rocket attack.

In better weather, another rescue attempt was made using 'Jolly Green 66' led by 'Sandy 03' with three more A-1s. The area seemed to have quietened a little, and Lt Col Bill Harris, 37th ARRS commander, took 'Jolly Green 66' down to Hambleton's hide-out. In the final moments of his approach heavy gunfire from a row of ten camouflaged armoured vehicles opened up, forcing Harris to turn away with severe damage. It began to seem as if the NVA was leaving Hambleton in place as bait to draw in and destroy US aircraft – a theory that was later reinforced by ARVN troops who were sure that the NVA was enjoying the 'no fire' zone and the commitment of a large proportion of US air power.

'Nail 38' (OV-10A 68-3789 of the 23rd TASS) returned to cover the rescue area. Descending to 2000 ft, supposedly below the minimum engagement altitude for SA-2s, pilot Lt Bill Henderson and observer 1Lt Mark Clark heard a warning of a SAM launch and took evasive action but saw no missile. Seconds later their aircraft was hit in the tail and a huge explosion engulfed the OV-10, shattering its canopy and throwing it into an impossible flight attitude. Both men immediately ejected, surviving gunfire as they parachuted down and landed near the Mieu Giang River.

Three Huey helicopters closed in for a quick rescue, but they were targeted by two salvos of SA-2s. No EB-66s were available to deal with these unexpected missiles. A UH-1H in the trio that would have rescued Clark and Henderson, and possibly Hambleton too, was repeatedly hit by ground fire and the three helicopters had to retreat to Quang Tri,

where all were written off due to flak damage. Henderson was discovered and captured an hour later.

Another rescue attempt on 4 April had to be abandoned despite strenuous 'Sandy' flak suppression. An A-1 was damaged by an SA-7 'Strela' missile, which was one of the USAF's first encounters with that weapon. A total of ten A-1s were sent to the target area that day and eight took hits.

On 6 April there were many more air strikes on the NVA by USAF and South Vietnamese aircraft. In the afternoon, another SAR force set out for Hambleton, who had evaded capture for four days. 'Sandy' leader Capt Fred Boli was to drop supplies for him in case rescue was impossible again. Two 37th ARRS HH-53Cs were included, and 'Sandy' A-1s prepared the area with cluster bomb units and 20 mm fire while the helicopters held off.

As 'Jolly Green 67' (68-10365) moved in to pick up Hambleton, surrounded by four A-1s, it was targeted by ground fire from all directions. Pilot Capt Peter Chapman hastily abandoned his attempt, but as he sought a safe exit his helicopter was repeatedly hit whichever way he turned. A fire in the left engine was followed by disintegration of both rotors and a fiery crash that incinerated the helicopter and all six of its crew. Clearly further attempts at rescue by air were far too risky. At least ten men had been lost, together with eight aircraft. Four more were badly damaged. In all, 800 strike sorties – sometimes up to 25 per cent of the sorties in that area – had been flown in support of the rescue effort.

Gene Hambleton remained in hiding in his small pit in the jungle, trapped between two armies in conflict while his eventual recovery by more covert methods was planned. A Special Forces team led by Marine Lt Col Andy Anderson and US Navy SEAL Lt Tom Norris devised a plan for the extraction of Lt Mark Clark ('Nail 38 Bravo'), who was hiding near the Mieu Giang River. Hambleton, more than half a mile from the river, had to be guided there using secret code-word directions based on reconnaissance by FACs. En route, he was stabbed in the back by a resident of the village that had housed the main AAA sites. The team set up a position on shore on 10 April, evading constant enemy patrols, and waited for Clark to float downstream for them to rescue him successfully. Hambleton, wounded and close to total exhaustion, also made it to the river.

Norris and Vietnamese commando Nguyen Van Kiet disguised themselves as fishermen and took a sampan along the river through extensive enemy activity. They found Hambleton hiding in bushes near the shore and navigated the boat to safety, despite frequent challenges and gunfire from NVA positions – all of which were noted for air attack by US Navy A-4 Skyhawks and USAF A-1s minutes later. Under a smokescreen, they sailed to their safe outpost.

This rescue effort, the most complex and costly of its kind, showed the absolute commitment and determination of the rescuers who, throughout

Lt Col 'Gene' Hambleton, photographed in 1974, was the sole survivor of 'Bat 21's' six-man crew. The subsequent SAR effort undertaken to save him was the most complex and costly of its kind during the entire conflict in Vietnam (USAF)





This 42nd TEWS EB-66E-DL returned to Korat in 1972 with battle damage to its right J71. The scarred engine covers are stacked in the foreground (Terry Panopolis)

the war, brought back 1298 downed airmen. Back at Korat, Hambleton said, 'It was a hell of a price to pay for one life'. Lt Norris was awarded the Medal of Honor and Kiet received the Navy Cross. It also revealed the severe problems in communication and coordination during the final stages of America's presence in Southeast Asia.

Among the resources for North Vietnam's invasion force were vast numbers of SAM and AAA batteries that posed a threat far beyond the capabilities of the small EB-66 and *Wild Weasel* force remaining in the area. Their tasks at the time were made more complex by some technical problems that had occurred previously in 1968. As the numbers of US Navy vessels committed to Task Force 77 off the coast of Vietnam increased during the Spring Invasion, it was found that EB-66 jamming could interfere with US naval radars and communications, requiring some de-confliction of transmissions.

EB-66s were also powerless to combat the introduction of the deadly SA-7 SAM, which destroyed 45 aircraft between March 1972 and the end of the conflict in 528 reported launchings. While the EB-66s themselves operated well above the SA-7's 10,000 ft altitude, the missile had a slant range of 2.3 miles and its fairly small 1.3-lb TNT warhead was quite capable of inflicting lethal damage to both jet and reciprocating aircraft engines. Above all, its IR lead-sulphide heat detector was immune to ECM and could only be defeated by flares or violent evasive manoeuvres.

With Hanoi's Spring Offensive in full swing, eight more EB-66s were sent to Korat from Shaw's 39th TEWTS on 7 April 1972. In Operation *Freedom Train* B-52s attacked strategic targets near Vinh, Bai Thuong and Haiphong with devastating effect from 12-15 April. EB-66s and carrier-based EKA-3Bs were able to suppress many of the radars for the growing numbers of SA-2s. In all, 242 were fired during the operation, but only two aircraft (an A-7E and an F-105G *Wild Weasel*) were hit and the MiG interception effort consisted of four MiG-21s, three of which were downed by 432nd TFW

F-4Ds. The SA-2s had more success on 21 April when a SAM damaged a B-52, forcing it to make an emergency landing at Da Nang.

EB-66s were still heavily involved, although the complexity of providing escort and tanker support for them occasionally meant that missions had to proceed without their assistance. Communications jamming of VPAF fighters' GCI radio links by EB-66s played a part in the record MiG-killing engagements of 10 May 1972 when seven MiG-17s and four MiG-21s were destroyed by USAF and US Navy F-4 crews.

As President Nixon increased heavy air strikes throughout North Vietnam and mined its harbours, SAM batteries stepped up their efforts to reverse the American gains. The beginning of *Linebacker II* – devastating B-52 attacks on principal Hanoi and Haiphong targets – on 18 December 1972 forced SA-2 batteries that had moved south to return and defend those city areas during the massive 11-day bombing assault. In the years since the US drawdown of forces commenced in late 1968, North Vietnam had rebuilt and considerably strengthened its defences and added more powerful early warning radars.

The EB-66 fleet's age and maintenance demands now became serious obstacles. At times, only three or four of Korat's 23 EB-66s were mission ready. In September 1972 the total number fell to 15, including only five EB-66Cs, as the draw-down of US forces reduced the number of maintainers at Korat and the crippling shortages of spare parts continued. Nevertheless, the 42nd TEWS still provided up to 15 daily stand-off jamming sorties for the massive *Linebacker II* air operation – more than 100 aircraft were airborne to support the B-52s, with EB-66s being among the most important of them.

On the first night of the campaign (18 December), the 42nd TEWS pressed to within 46 miles of Hanoi with three aircraft, putting them at greater risk than during earlier *Linebacker I* missions. A flight of MiG-21s attempted to cut off their route to the coast and intercept them, but their F-4 MiGCAP drove the enemy fighters off when they were five miles from their target.

The Destroyers then faced a barrage of six SAMs, and had to evade them before returning to their jamming pattern. Nine EB-66Es were among an EW force of 40 aircraft covering the raid, including 27 US Marine Corps and US Navy participants. Among the latter were five of the US Navy's new EA-6B Prowler four-seat ECM aircraft and five US Navy EKA-3Bs, the Skywarriors strengthening the long-range jamming effort. One EB-66 that found itself short on fuel was saved by a KC-135A crew venturing into North Vietnam beyond their prescribed limits.

BATTLE OF THE 'BUFFS'

The B-52s' problems had actually begun with the destruction of the first bomber well before the Christmas attacks. Having damaged a B-52D on 23 April 1972, the Soviet-managed SA-2 batteries near Vinh finally brought down a bomber on 22 November. Capt Norbert Ostrozny's U-Tapao-based B-52D was in a cell protected by three EB-66 barrage jammers, two F-105Gs and a chaff corridor spread by four F-4s. Ideally, chaff would remain in the air for more than an hour, although North

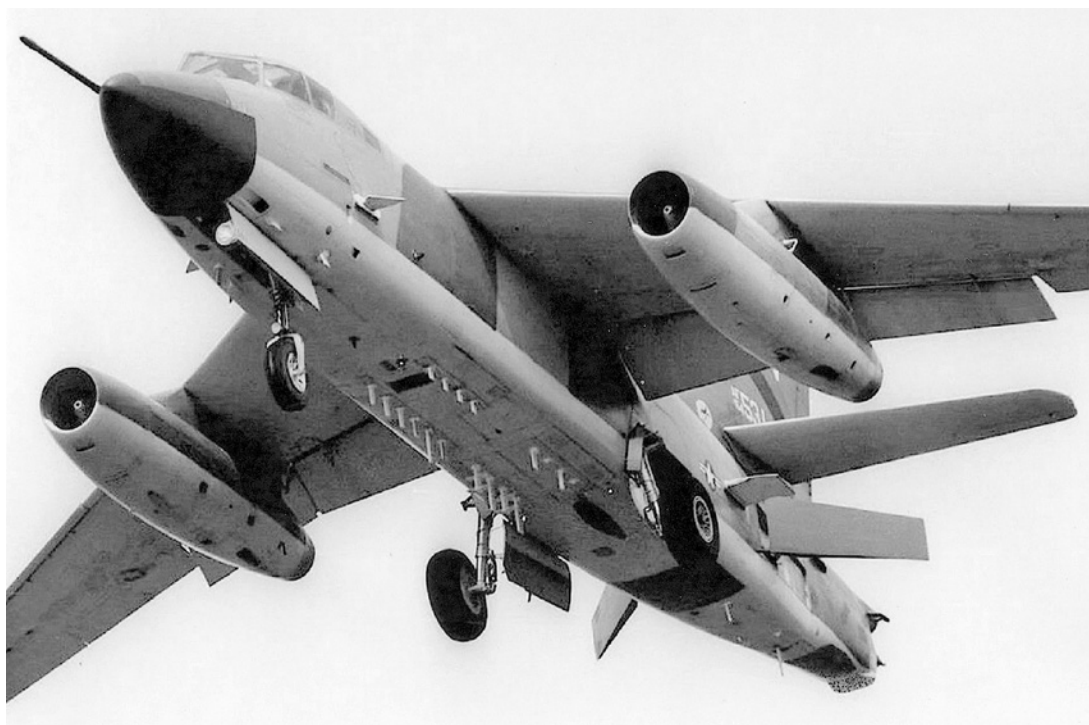
Vietnamese radar operators could adjust their frequencies to penetrate it when they worked out what type of chaff was in use and which wavelengths it was designed to blot out. As the bomber turned away from the target after releasing its ordnance, the B-52 revealed the weakness in its own ECM defences that no amount of additional EW support could remedy.

Although its seven powerful AN/ALT-22 and AN/ALT-28 jammers made the D-model the best-equipped B-52 variant, their emissions were directed downwards only while the jet was flying straight and level. AN/ALT-22s could then jam the 'Fan Song's' track-while-scan beacon, although the hostile radar could sometimes burn through that jamming when the B-52s were directly overhead. In a banking post-target turn, however, the jamming signals were projected outwards at an angle until the bomber had completed its turn, leaving it vulnerable to 'Fan Song' detection. That weakness was the biggest contributor to B-52 losses in December.

The SAM battery managed to acquire Ostrozny's B-52 as a target with a short radar transmission during its turn, having tracked the bomber passively up to that point and fully aware that their targets flew at around 35,000 ft. The aircraft was severely damaged by two SA-2s detonating below it. Ostrozny nursed the massive bomber back towards Thailand and the crew ejected 12 miles from Nakhon Phanom. These passive techniques denied the *Wild Weasels* any radar targets, while the EB-66s had no time to detect and analyse the hostile transmissions. Similar B-52 approach, delivery and turn-to-exit tactics were used throughout the December attacks.

Despite the more effective SAM techniques, EB-66s and other ECM aircraft remained vital to the B-52Ds, for although the bombers used

EB-66E-DL 54-531 with 'everything out' and a complex array of antennas on show in 1972. The cavities of the ailerons and flaps were filled with Stafoam plastic foam after vibration-induced fatigue cracks were detected. Unfortunately, it deteriorated when soaked with condensation at high altitude, encouraging the growth of algae, as well as increasing the weight of the control surfaces. This in turn made the Destroyer less agile (USAF)





many of the same jammers as the Destroyer, they had too few of them. The situation was even worse for the B-52Gs, which lacked AN/ALT-22s – the most effective jammer for SA-2s, and a key part of the EB-66B/E ECM suite. The B-52s' older AN/ALT-6Bs, also used in EB-66C/Es, were only half as powerful, and there was no funding to upgrade the B-52Gs.

Also, the bombers had only one ECM operator aboard, rather than the team of four in an EB-66E. Managing all his receivers and jammers single-handed became a frantic 'computer game' over the target. Even so, the combined efforts of all the 'Ravens' could not overcome North Vietnam's hostile radar complex, and 15 B-52s were lost during *Linebacker II*. Of the total of 26 USAF and US Navy losses during the brief campaign, SA-2 batteries could claim 17. More than 1000 SAMs had been fired to achieve this success, however, temporarily exhausting North Vietnam's supply.

Despite having ideal launch conditions for dozens of overlapping SAM sites, the SA-2's performance was severely degraded by ECM aircraft. There were no EB-66 or EA-6B losses near the targets, despite those stalwart ECM crews attending every attack and taking up position 15 minutes ahead of each one within range of SAM sites.

In fact, a lost engine contributed to the final wartime EB-66E loss. On 23 December 1972 'Hunt 02' (54-529) returned to Korat from a *Linebacker II* ECM operation near Haiphong harbour with a cockpit pressurisation problem. Just before touch down, the pilot, Maj George Sasser, announced that he had an engine failure and inexplicably elected to make a go-around second approach. The aircraft climbed back to 500 ft and began a turn, but it descended into a housing area for the Royal Thai Air Force. Maj Sasser and the navigator, Capt William Baldwin, ejected and hit the ground before their parachutes opened. EWO Maj Henry Repeta perished in the crash.

Failing engines and a shortage of replacements were serious problems throughout 1971-72, reducing daily sortie rates for the 19 available aircraft to only eight in September. The availability rate barely reached 50 per cent by the end of 1972.

The EB-66C's radome covered the antenna for the AN/APS-63 search radar, or the similar AN/APS-27 in the EB-66E. Behind it in the lower nose was the AN/ANR-21 TACAN set. The large canopy gave the pilot an unusually good panoramic view, particularly to the left. The navigator had one small window and the four 'Ravens' in the bomb-bay were restricted to tiny transparencies. Both Destroyers (with EB-66C-DT 54-469 in the foreground) display the 39th TEWTS patch in this March 1972 photograph taken at Shaw (Terry Panopolis)

EB-66s and F-105Gs were the most important aircraft when it came to reducing B-52 losses. They had to contend with frequent movement of SA-2 sites between B-52 attacks, very brief transmissions by hostile radars, constant changes of frequency and other tricks that the SAM operators had refined during their eight years with their equipment. Overall, the complexity and close organisation of the air defence network covering a relatively small land area meant that although it could be degraded by EW, it was never fully blind to US air activity.

The EB-66s' unique capabilities had made them vital assets long after their intended retirement date, but several factors made their demise in the wartime scenario inevitable. The lack of investment in updating their sensors reduced their validity as ELINT and jamming platforms in the early 1970s. Also, their reliance on the drogue refuelling method placed unwelcome demands upon the KC-135A tanker fleet as TAC had removed its other two drogue-reliant aircraft, the F-100 and F-104, from Southeast Asia by 1970. US Navy KA-3s and US Marine Corps KC-130Fs were sometimes available over the Gulf of Tonkin for EB-66s with emergency fuel situations.

Modification of EB-66s for receptacle-type refuelling was potentially a costly process that would have reduced the aircraft's limited availability when it was most needed. Scarcity of appropriately equipped KC-135s began to cause Destroyer mission cancellations or a reduction in their duration. EB-66s regularly took off with partial fuel loads due to their excessive all-up weight, so refuelling was usually essential. Without it, an EB-66C could only manage an inadequate one-hour mission. In January 1973 the 42nd TEWS was required to support 192 *Arc Light* sorties over Laos and southern North Vietnam. By March that total had fallen to 41, and it ended altogether on 17 April. EB-66C ELINT flights over Laos and Cambodia, ensuring that Hanoi was complying with the peace accords, continued until mid-August, with up to four daily sorties. No hostile radars were detected.

The pace of retirement accelerated after the last EB-66C ELINT mission was flown on 24 December 1973, followed by the cancellation of flying operations two days later. The 24 surviving EB-66s joined many other Vietnam veteran aircraft at Clark AB for salvage. The last four arrived on 17 January 1974 and the 42nd TEWS was inactivated on 15 March. Shaw's final squadron, the 39th TEWTS, flew its last sortie on 4 January 1974 and was inactivated on 15 March.

The EB-66's success in Vietnam was hard to quantify except in terms of missions flown. On some occasions it was not clear whether successful radar suppression had been achieved mainly by the EB-66s, US Navy EA/EKA-3Bs or US Marine Corps jammers, or more often by a combination of all three. Whereas MiG kills or bomb tonnages were quite easy for statisticians to measure, the EB-66's achievements had to be estimated in terms of aircraft not shot down, bombing missions not aborted or radar sites probably destroyed. On all those counts, it was at least clear that the US air campaign against North Vietnam would have been prohibitively costly, particularly in 1965 to 1967, without the protection offered by the Destroyers.



CHAPTER SEVEN

STILL IN EUROPE

On 1 April 1969, while Vietnam War demands on the small EB-66 community were still heavy, the 39th TEWS was activated at Bitburg AB, West Germany, within the 36th TFW – an F-4 wing with a satellite base at nearby Spangdahlem, where the 39th would relocate with the 52nd TFW on 31 December 1972. Both bases were comparatively luxurious postings for crews after wartime conditions in Thailand. The importance of electronic warfare had been emphasised by the Vietnam experience, and it was now seen as even more essential for NATO's purposes too as SAMs (including advanced SA-3s) were appearing in great numbers on the other side of the Iron Curtain.

Some of the squadron's crews and 16 EB-66C/Es were still rotated to bases in Thailand until the war ended, placing considerable strains on the 39th TEWS. Several of the RB-66Cs had begun their operational careers at Spangdahlem in 1956 and returned there in 1969, only to be sent back to Thailand shortly afterwards. Their crews in 1969 all had Southeast Asian combat experience, and many had several thousand hours on the RB-66. They came from Shaw, where many had also been instructors, leaving the base in South Carolina depleted of aircraft and crews. The initial complement of four EB-66Es and two EB-66Cs was expected to expand to full squadron size with 20 aircraft, but there were never more than 17 jets assigned, including only four EB-66Cs.

EB-66C-DT 54-465 bears the markings of the 39th TEWS/36th TFW during the aircraft's time at Bitburg from 1969 to 1972. It then returned to the 363rd TFW and was selected for preservation at the air base (*Author's collection*)

In West Germany, their initial task was to give NATO crews experience of electronic warfare in the *Creek Girl* programme, which was a similar arrangement to the efforts of the 19th TRS *Dancing Girl* programme of the early 1960s. They flew sorties in Exercise *Black Eagle* to train air defence radar operators in Denmark and even deployed to Tehran to evaluate the effectiveness of the Shah of Iran's air defence radars when confronted with the massive jamming energy from an EB-66E. The unit also monitored Soviet naval forces in the Mediterranean and simulated Soviet Tu-16 bombers in practice strikes on US Navy ships assigned to the Sixth Fleet. Practice interceptions by NATO fighters were also routinely undertaken, with 'attacking' pilots having to deal with jamming and chaff from the Destroyers.

From an operational standpoint, one of the EB-66C's major responsibilities was the monitoring of Soviet radars on the East German and Czech borders, just as the aircraft had done before the Vietnam War interrupted its Cold War routines. There were new threats to detect too, including the control radar for the SA-6 'Gainful' SAM. Operational missions were regularly shortened by the lack of KC-135A tankers and the inability of the deployed ANG KC-97 units to offer the EB-66s' inflight refuelling in the restricted, crowded airspace of central Europe.

USAFE EB-66 units had the same problems with spares shortages, maintenance difficulties and personnel scarcity that afflicted the units in Thailand, and their credibility as a NATO protective force was steadily weakened. In 1972 the North Vietnamese Spring Invasion took several crews back to Korat to reinforce the 42nd TEWS for operations *Freedom Train* and *Linebacker I*. When *Linebacker II* began in December 1972, aircraft from the 39th TEWS had already been dispersed to Korat or to Shaw, and the West Germany-based unit had to be inactivated on 1 January 1973.

After the withdrawal of the Destroyer in 1974, the USAF had no dedicated EW aircraft until the General Dynamics/Grumman EF-111A Raven entered service in small numbers in 1981, eight years after the EB-66 had been retired. Development work on the EF-111A began in 1974, using converted F-111A bomber airframes with EW systems that were similar to the EA-6B's ALQ-99, but long delays resulted from unjustified Congressional doubts about the aircraft's structural integrity – a problem which had been remedied by 1971.

The most obvious alternative was the US Navy's EA-6B Prowler, a highly capable EW aircraft that was to remain in service until 2019. In 1973, Gen William Momyer, then commander in chief of TAC, considered that it had equipment that was 'considerably less capable from a systems standpoint than the EB-66' for the USAF support jamming role, and he strongly opposed buying it for the USAF. Momyer also preferred a supersonic aircraft for the Tactical Jamming System to accompany strike forces, rather than the distinctly subsonic EB-66 and EA-6B.

Ironically, following the withdrawal of the EF-111As in 1998 after a very successful career that included several combat deployments, the USAF's EW mission passed to 16 EA-6Bs, operated by four joint USAF/US Navy-manned squadrons. Clearly, the USAF had not fully accepted the importance of tactical ECM aircraft despite the evidence offered in



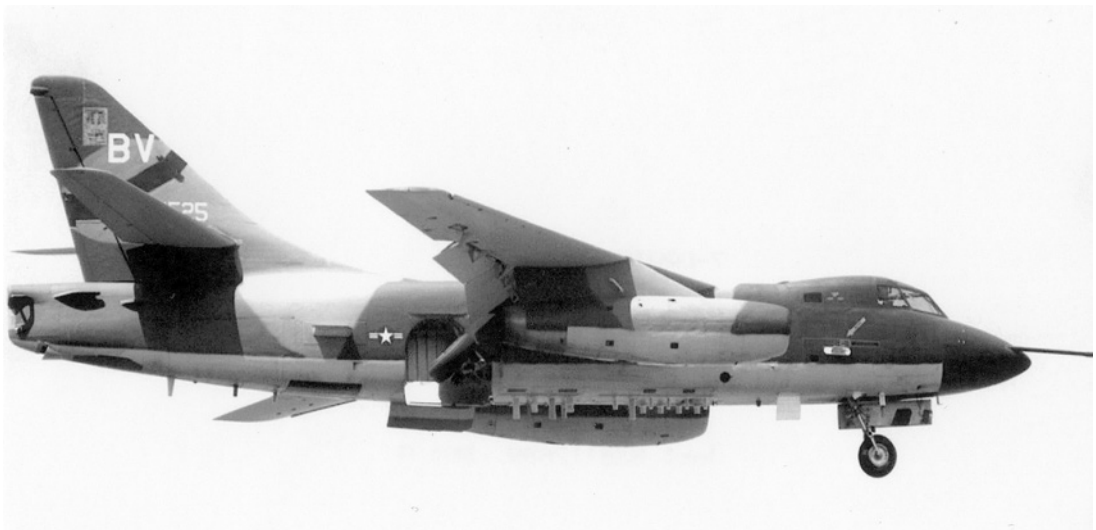
Vietnam. Instead, attention turned to the development of stealth aircraft to penetrate enemy radar networks without the need for jammers.

While the EF-111A was awaited, parts of the EW task were absorbed by other types. In the mid-1970s a few RF-4Cs were equipped with the *Pave Onyx* tactical electronic reconnaissance sensor system, Litton Industries supplying 23 AN/ALQ-125 kits that enabled the aircraft to detect, identify and locate ten types of hostile AAA or SAM radars. From the late 1970s, EC-130H *Compass Call* aircraft provided ELINT and jamming capability, as well as fielding systems that could disrupt enemy air defence communications, in cooperation with the EF-111As. U-2Rs were also able to locate and identify hostile radars. However, there was no single type to perform all the EB-66's myriad EW tasks.

Adm Thomas Moorer, chairman of the Joint Chiefs of Staff from 1970 to 1974, warned that 'if there is a World War 3, the winner will be the side that can best control and manage the electromagnetic spectrum' – something the RB/EB-66 had done with aplomb for much of its service career.

This early NRB-66B (53-413) was converted in 1969 by Texas Instruments and General Precision to test the Mk 1 avionics for the General Dynamics F-111A in a grafted-on F-111 radome. It was stored at the MASDC from February 1970 and salvaged in August 1975 (*Terry Panopalis*)

The landing gear of EB-66E-DL 54-525 of the 39th TEWS/36th TFW completes its complex retraction cycle on 3 June 1970 (*USAF*)



APPENDICES

COLOUR PLATES

1

B-66B-DL 55-(0)311 of the 85th BS/47th BW, RAF Sculthorpe, England, 1960

B-66Bs assumed the nuclear alert task from B-45As in the 47th BW from 1956 until the wing was inactivated in June 1962. The Destroyers were then sent to the Military Aircraft Storage and Disposition Center (MASDC) at Davis-Monthan AFB, Arizona, and a few were rebuilt as *Brown Cradle* ECM aircraft. This example, however, remained in desert storage until it was salvaged in October 1973.

2

B-66B-DL 55-(0)309 of the 84th BS/47th BW, RAF Sculthorpe, England, June 1959

This aircraft was from the final batch of 13 B-66Bs that shared the nuclear alert mission at Sculthorpe until June 1962. It was then sent to the MASDC for storage and salvaged in 1964.

3

B-66B-DL 53-495 of the 85th BS/47th BW, RAF Alconbury, England, 1958

In 1959 this bomber became one of 13 *Brown Cradle* EB-66Bs. It was then assigned to the 42nd TRS/10th TRW, where EB-66Bs replaced the weather reconnaissance WB-66Ds in 1960. The jet was transferred to the 6460th TRS(TEWS)/460th TRW (later, 432nd TRW) at Takhli, before operating with the 355th TFW in 1968. Assigned to the 19th TEWS/363rd TRW in 1969, 53-495 was retired to the MASDC in October of that same year and had been salvaged by September 1975.

4

RB-66B-DL 54-506 of the 19th TRS/66th TRW attached to the 47th BW, RAF Sculthorpe, England, 1957

The 66th TRW's distinctive engine banners were removed when the 19th TRS transferred to the 10th TRW at Bruntingthorpe in August 1959. This aircraft crashed in the North Sea on 16 March 1961 during a three-aircraft night photographic training flight for NATO Exercise *Royal Flush*. The pilot, Capt Harry Armani, had reported a radar problem during a racetrack photoflash run and he began to follow the other two aircraft off the range. A fire was later observed and wreckage subsequently recovered. All three crew were killed.

5

RB-66B-DL 53-(0)429 of the 16th TRS/363rd TRW, Shaw AFB, South Carolina, 1959

A former RB-26C 'night photographic' training squadron in the 1950s, the 16th TRS converted briefly to the unsatisfactory RB-57A. In 1956 it became the first unit to convert to the RB-66B, and this was one of 16 aircraft on strength by June. It was sent to the MASDC in October 1969.

6

RB-66B-DL 53-(0)415 of the 9th TRS/363rd TRW, Takhli RTAFB, Thailand, 1965

On returning to Shaw from Takhli in 1965, this aircraft was used by the 4417th CCTS to train crews for in-flight refuelling. It was

lost on a night refuelling training sortie on 24 June 1969 when an engine caught fire after the aircraft disconnected from the tanker. Instructor pilot Maj Edwin Welch managed to eject, only to be killed when he fell 40 ft from a tree in which his parachute had become entangled.

7

RB-66B 54-421 of the 19th TRS/66th TRW, RAF Sculthorpe, England, May 1957

Another aircraft from the 19th TRS that transferred to the 10th TRW at Bruntingthorpe in August 1959, 54-421 is depicted here in 66th TRW markings more than two years prior to the move. It was returning from maintenance at RAF Alconbury on 14 December 1959 as 'Puff 05' when, approaching Bruntingthorpe to land at 1950 hrs, the crew had difficulty in finding the base. The Destroyer crashed three miles from the airfield, killing pilot 1Lt Gary Coad, navigator 1Lt Charles Boone and gunner A/2C Ralph Noell.

8

RB-66B-DL 54-(0)528 of the 30th TRS/10th TRW, RAF Alconbury, England, 1960

In 1960-61 this RB-66B flew with the 30th TRS, and it remained in 10th TRW service until it entered storage at the MASDC in 1965. The yellow squadron band on the engine pods was carried until late 1960. Converted to EB-66E configuration by March 1969, 54-528 was then assigned to the 39th TEWS/36th TFW. Moving to the 52nd TFW in 1972, the aircraft ended its career with the 363rd TRW in 1974 and was salvaged at the MASDC in 1976.

9

RB-66B-DL 54-529 of the 10th TRW, Toul-Rosières AB, France, 1964

Totally devoid of unit markings, this aircraft was placed in storage at the MASDC in September 1965. Converted into an EB-66E in June 1968, it briefly served with the 363rd TRW prior to being transferred to the 39th TEWS/36th TFW in 1969. Sent back to the MASDC in October 1969, 54-529 returned to the 39th TEWS, which was now part of the 52nd TFW at Spangdahlem AB, in 1972. Returned to the 363rd TRW shortly thereafter, it was then transferred to the 42nd TEWS/388th TFW at Korat. An engine failed on landing approach on 23 December 1972 and it became the last EB-66 loss of the Vietnam War.

10

RB-66B-DL 54-440 of the 1st TRS/10th TRW, Toul-Rosières AB, France, 1959

This RB-66B also flew with the 19th TRS during its time at Toul-Rosières, the aircraft eventually moving to the 25th TRG in 1965 and being converted into an EB-66E the following year. After service with the 363rd TRW, it was transferred to the 42nd TEWS/355th TFW at Takhli in 1968 and then on to the 19th TEWS/18th TFW. 54-440 was eventually sent to the MASDC by the 42nd TEWS/388th TFW in 1970.

11**WB-66D-DT 55-402 of the 9th TRS/363rd TRG, Shaw AFB, South Carolina, 1961**

Another 'plain Jane' Destroyer, this WB-66D (based on the RB-66C) never received the complete sensor and communications equipment that would have made it fully capable of undertaking its specialised weather reconnaissance mission tasking. It was therefore the first B-66 variant to be retired. Originally issued to the 42nd TRS/10th TRW, 55-402 was sent to the MASDC in November 1964 and struck off charge in October 1970.

12**WB-66D-DT 55-(0)393 of the 9th TRS/363rd TRG, Shaw AFB, South Carolina, 1964**

This WB-66D, seen here with seldom-carried 450-gallon drop tanks, was fitted with an AN/AME-1 radiosonde ejector, an AN/AMR-3 receiver for the AN/AMT-6 radiosonde units and a P-220 camera for cloud photography. This example also had its tail gun turret replaced by the standard ECM tail cone. It was retired to the MASDC in October 1964. The aircraft was struck off charge in October 1970 and scrapped in September 1975.

13**NB-66B-DL 53-(0)488 of the 6511th Test Group (Parachute), Aerospace Recovery Facility, National Parachute Test Range, NAS El Centro, California, March 1962**

Built as a B-66B-DL, this aircraft was operated by the 86th BS/47th BW at Alconbury from 1958. It was then used by the 6511th Test Group (Parachute) at the Aerospace Recovery Facility, located at the National Parachute Test Range at NAS El Centro, to test parachutes for the recovery of Gemini and Apollo space capsules. Between 1963 and 1967 the jet was assigned to the Air Force Flight Test Center. Moved to the MASDC in June 1972, the aircraft was not chosen for EB-66E conversion and struck off in February 1974 and salvaged in November 1976.

14**RB-66C-DT 54-459 of the 42nd TRS/10th TRW, Spangdahlem AB, West Germany, November 1956**

As the first RB-66C to be based outside the USA, and the first to reach the 42nd TRS at Spangdahlem, this aircraft was treated to a welcoming ceremony attended by the mayor of Wittlich, the local town. A ceremonial shield with the titling *Krier Wittlich* was applied to its nose for the occasion. In July 1962 the jet moved to Toul-Rosières and then on to Chambley-Bussières with the 25th TRG. It left Europe in March 1966 for conversion into an EB-66C, followed by further USAF service and a combat tour with the 355th TFW in Thailand. As with most surviving 41st TEWS aircraft, this jet was flown to Kadena shortly after Linebacker II had ended. It was scrapped there in October 1973.

15**RB-66C-DT 54-474 of the 11th TRS/67th TRW, Yokota AB, Japan, January 1959**

The 11th TRS flew RB-66Cs and WB-66Ds from August 1957 to March 1960. Whilst at Yokota, the Destroyers undertook many reconnaissance missions as PACAF surveyed Chinese and Soviet targets from offshore positions. MiGs were a frequent threat during this period. This aircraft was then transferred to the 42nd TRS/10th TRW at Chelveston and its final fate is unknown.

16**RB-66C-DT 54-452 of the 9th TRS/363rd TRG, Shaw AFB, South Carolina, 1958**

The 9th TRS received its first RB-66Cs in May 1956, using them for radar system training for ADC fighters and US Army AAA units. It also pioneered the CASF concept in foreign deployments to Europe and the Far East. The red and white 'chequertails' were a trademark for several of Shaw's squadrons, extending back to the wing's time with RB-26s, RF-80As and RF-84Fs. 54-452 subsequently served with the 12th TRS/67th TRW at Yokota until the unit was inactivated on 8 March 1960. The jet was then placed in storage at the MASDC and eventually salvaged.

17**EB-66C-DT 54-469 of the 42nd TEWS/355th TFW, Takhli RTAFB, Thailand, March 1970**

This Destroyer's career began with the 42nd TRS/10th TRW, and it was transferred to the 25th TRG at Chambley-Bussières in 1965. Reassigned to the 41st TEWS/363rd TRW the following year, the jet was upgraded to EB-66C specification in 1967. The aircraft saw operational service with the 42nd TEWS/355th TFW from Takhli in 1970, after which it returned to the 363rd TRW at Shaw in 1972. 54-469's final assignment was with the 42nd TEWS/388th TFW at Korat, from where it was sent to Clark in 1974 for salvage.

18**EB-66C-DT 54-469 of the 39th TEWS/363rd TRW, Shaw AFB, South Carolina, March 1972**

Also the subject of the previous profile, 54-469 is depicted here following its return to Shaw and fitment with a modified tail cone and underbelly pannier. The aircraft's time at Shaw would be short, for it commenced a second combat tour (this time with the 42nd TEWS after the unit had joined the 388th TFW at Korat) in late 1972. The severe shortages of EB-66Cs for training purposes at Shaw were exacerbated by frequent requests for more of these precious aircraft for service in Southeast Asia.

19**EB-66C-DT 55-385 of the 41st TEWS/355th TFW, Takhli RTAFB, Thailand, 1969**

Originally a 42nd TRS/10th TRW RB-66C from 1960, 55-385 was updated to EB-66C configuration and joined the 355th TFW for combat operations – it featured the nickname *CHERRY BOMB* and associated firework-inspired artwork on a maintenance hatch during this period. In 1970 the aircraft moved to the 42nd TEWS/388th TFW at Korat, and it was salvaged at Kadena three years later.

20**EB-66C-DL 54-459 of the 39th TEWS/36th TFW, Spangdahlem AB, West Germany, 1970**

Also the subject of profile 14, this aircraft was converted from RB-66C configuration into an EB-66C and then issued to the 363rd TRW in June 1966. The jet later returned to Spangdahlem in April 1969 when it joined the 39th TEWS/36th TFW, before transferring to the 52nd TFW in 1971 and then briefly re-joining the 363rd TRW. Called to action in Thailand with the 41st TEWS/355th TFW in 1972, 54-459, which was known for its reliability, was also salvaged at Kadena in October 1973.

21

EB-66E-DL 54-446 of the 19th TEWS/363rd TRW, Shaw AFB, South Carolina, April 1968

Initially serving as an RB-66B with the 1st TRS/10th TRW in 1960 at Alconbury, this aircraft remained with the USAFE wing until it was sent to the MASDC for storage in April 1965. In March of the following year the jet became an EB-66E, flying with the 363rd TRW until it was sent to the 42nd TEWS/355th TFW for combat duties. The Destroyer returned to the MASDC in September 1970 and was salvaged in November 1976.

22

EB-66E-DL 54-443 of the 42nd TEWS/388th TFW, Korat RTAFB, Thailand, January 1971

Built as an RB-66B, this aircraft was delivered to the 1st TRS/10th TRW in 1961 at Alconbury. It flew with the wing until July 1965, when the jet was sent to the MASDC for storage. In February 1966 the Destroyer was converted into an EB-66E and operated by the 4411th CCTG. The aircraft was supplied to the 42nd TEWS/388th TFW at Korat in January 1971 and 54-443 ended its career here in October 1973 when it was salvaged.

23

EB-66E-DL 53-479 of the 42nd TEWS/388th TFW, Korat RTAFB, Thailand, 1972

This Destroyer entered service with the 363rd TRW as an RB-66B, and in 1965 it was sent to the MASDC. In April 1968 the jet was converted into EB-66E configuration, re-entering service with the 39th TEWTS at Shaw. In October 1970 53-479 flew to Korat for the 42nd TEWS/388th TFW, and the jet saw considerable combat prior to its withdrawal and salvage at Clark in 1973.

24

EB-66E-DL 53-480 of the 39th TEWTS/363rd TRW, Shaw AFB, South Carolina, 1970

This aircraft was also originally an RB-66B, and it too served with the 363rd TRW until consigned to the MASDC in January 1965. Stored for more than four years until refurbished as an EB-66E in June 1969, it was then assigned to the 39th TEWTS/363rd TRW until the type's withdrawal from service in 1974. The aircraft was then retired to the MASDC once again.

25

EB-66E-DL 54-527 of the 41st TEWS/355th TFW, Takhli RTAFB, Thailand, February 1968

Originally delivered to the 19th TRS/10th TRW as an RB-66B, this aircraft was returned to the USA in 1966 and upgraded to EB-66E standard prior to being reissued to the 363rd TRW. It then flew with the 41st TEWS/355th TFW from Takhli until in October 1970, when the aircraft was sent to the MASDC for storage. The Destroyer was finally salvaged in September 1975, having served as a 'parts store' for the remaining operational EB-66s.

26

EB-66E-DL 54-442 of the 39th TEWS/36th TFW, Spangdahlem AB, West Germany, 1969

54-442 was built as an RB-66B and initially served with the 19th TRS/66th TRW at Sculthorpe from 1957. It then moved to the

10th TRW at Spangdahlem, where it remained until 1964. The Destroyer was stored at the MASDC from July 1965 until it was converted into an EB-66E in 1968. Reassigned to the 39th TEWS/36th TFW the following year, the aircraft moved with the squadron to the 52nd TRW in 1971. 54-442's final assignment was a combat deployment with the 42nd TEWS/388th TFW at Korat in 1972, and it was salvaged the following year.

27

EB-66E-DL 54-531 of the 39th TEWS/52nd TFW, Spangdahlem AB, West Germany, 1971

After service with the 10th TRW in 1963-64, this aircraft was sent to the MASDC in March 1965. Converted into an EB-66E in February 1969, the Destroyer was transferred to the 39th TEWS/36th TRW in 1971 and then to the 52nd TRW in 1972. 54-531 was subsequently reassigned to the 363rd TRW prior to returning to the MASDC in 1974.

28

EB-66E-DL 54-442 of the 39th TEWTS/363rd TRW, Shaw AFB, South Carolina, 1971

Delivered new to the 19th TRS/10th TRW in 1957, 54-442 remained with the wing until it was sent to the MASDC in July 1965. In April 1968 it was one of a number of RB-66B converted into EB-66Es, re-entering service with the 39th TEWS in 1969. It joined the 42nd TEWS/388th TFW at Korat in early 1972, and on 4 February that same year it suffered a total electrical failure on approach to Nakhon Phanom. The pilot was able to land while the navigator shone a flashlight on his remaining flight instruments for him. The braking parachute failed and a tyre blew out, but the aircraft was recovered with minimal damage. Quickly repaired, it soldiered on until salvaged in October 1973.

29

EB-66E-DL 54-520 of the 19th TEWS/18th TFW, Kadena AB, Okinawa, 1970

Like many other RB-66Bs, this aircraft started its service life with the 1st TRS/10th TRW in 1958 and remained with that unit until 1964. Following brief storage at the MASDC from April 1965, the Destroyer was converted into an EB-66E in April 1966. Used in a training role with the 363rd TRW, it was reassigned to the 19th TEWS/18th TFW in early 1970 and withdrawn from service in October of that same year when the squadron was inactivated. The aircraft was scrapped at Kadena in October 1973.

30

EB-66E-DL 54-542 of the 19th TEWS/18th TFW, Kadena AB, Okinawa, 1970

This aircraft also initially served as an RB-66B with the 10th TFW, being assigned to the 30th TRS until sent into storage at the MASDC in June 1965. Converted into an EB-66E in October 1967, the Destroyer then served with the 19th TEWS/363rd TRW at Shaw. In February 1968 it flew to Osan AB, South Korea, and Itazuke AB, Japan, in Operation *Combat Fox* in response to the *Pueblo* crisis. The aircraft remained with the 19th TEWS/18th TFW until the inactivation of the squadron in October 1970. Flown back to the USA, 54-542 was immediately sent to the MASDC and stored until salvaged in November 1976.

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Front Cover

Escorting EB-66s, a prime VPAF target, led to a MiG encounter on 12 May 1966. Maj Ray Dudley and 1Lt Imants Kringelis were 'Jupiter 03' in a 390th TFS/35th TFW F-4C Phantom II escort for 41st TRS/432nd TRW EB-66C 55-387 flown by Lt Col Allen 'Spider' Webb, with navigator Capt Verla O Eary, instructor navigator 1Lt William Hill and four electronics operators. Twenty miles from the Chinese border in North Vietnam, at the eastern end of its orbit to support an F-105 strike near Hanoi, the Destroyer crew detected three 'MiG-17s' (Chinese-built J-6s) approaching. Lt Col Webb, CO of the 41st TRS, turned towards them, forcing the communist pilots to break formation. A fourth MiG then turned in behind the EB-66 and opened fire with its 23 mm cannon. It was at this point that Dudley engaged afterburner and fired two AIM-9B missiles. The second blew the MiG's tail off.

The Chinese government claimed ownership of the attacking fighters, stating that five US aircraft had penetrated 25 miles inside its border and engaged the MiG-17s. They also stated that the EB-66 was destroyed by their pilot, Si Heng Zhu. Webb's crew duly suffered an eight-day-long USAF interrogation and hostile press coverage as a result of China's claims. RB-66C 55-387 was subsequently destroyed by an SA-2 on 4 February 1967, while Dudley's F-4C, 64-0660, became a triple MiG-17 killer (*Cover artwork by Gareth Hector*)

Title Pages

The demand for EB-66s in Southeast Asia as NVA advances accelerated in 1971 resulted in the 363rd TFW having to give up more and more aircraft for operations in-theatre. EB-66E 54-520 was one such jet, photographed at Korat with the 42nd TEWS in 1971 whilst still wearing the colours of its former operator. This aircraft was eventually salvaged at Kadena in October 1973 (*Terry Panopalis*)